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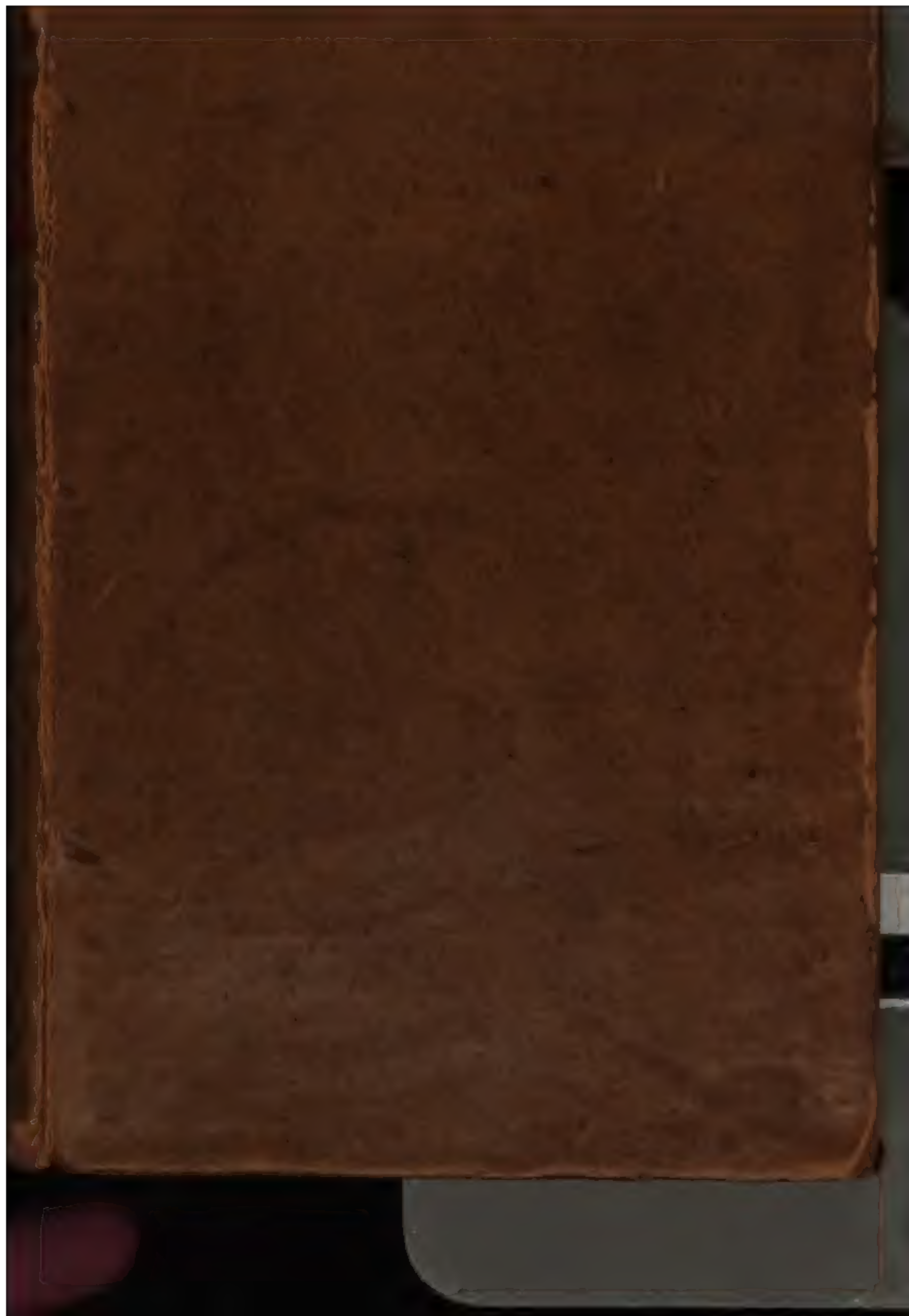
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B Y  
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V O L U M E VII.  
THE SEVENTH EDITION,  
CORRECTED AND ENLARGED.

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CHAPTER XXXIX.

*Of FRACTURES.*

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SECTION XII.

*Of Fractures of the Femur or Thigh-Bone.*

**W**E meet with fractures in every part of the femur; but more frequently in the middle than in any other part of it: Next to this, that part of it which we term the Neck of the Femur, is most apt to be fractured.

Fractures of all the under part of this bone are for the most part easily distinguished,



guished, by the usual grating noise produced by the ends of it being forcibly rubbed together; by the limb being much shortened if the fracture is oblique, or the ends of the bone displaced where the fracture is transverse; by much pain and tension over the injured part; and by the limb being rendered unable to sustain the weight of the body.

It is often difficult, however, to distinguish fractures of the neck of the femur from dislocations of this bone; but a due attention to the following circumstances will enable us for the most part to avoid mistakes in regard to this, which are always attended with serious consequences.

In a great proportion of cases, perhaps in ninety-nine of every hundred, the head of the femur when dislocated is pushed inwards and downwards, owing to the brim of the acetabulum being not so deep in this part as in others; while in fractures of the neck of the femur, the bone has in every instance that I have seen of it been drawn upwards, and the leg thereby rendered

dered shorter by three or four inches, in consequence of the powerful exertion of the glutæi muscles on a bone deprived of its ordinary support. In all such cases, therefore, the trochanter is found to be much higher than the trochanter of the other thigh; and the knee and points of the toes turned inwards; while in those dislocations of the thigh-joint that I have mentioned, the leg is much lengthened, the head of the bone is found in the groin, and the trochanter is discovered on the fore-part of the thigh, while a corresponding vacancy is perceived where the trochanter and head of the bone should be, and the toes are turned outwards.

In every fracture, a grating noise is discovered on the ends of the bone being rubbed against each other; and in all fractures of the neck of the femur, we observe, that the leg and thigh may be turned with much more ease from one side to another, that is, the knee and foot may be moved with more ease outwards or inwards, than when the head of the

bone is dislocated. I may likewise remark, that, in dislocations, the tumor formed by the head of the bone and trochanter together, must always be larger than in fractures, where the tumor is formed by the trochanter alone.

In no part of surgery are practitioners more apt to be disappointed than in the treatment of fractures of the thigh, particularly where the neck of the bone is broken. This proceeds from various causes; all of which should be kept in view in forming a prognosis of the event.

1. The thigh-bone is so thickly covered with muscles and other soft parts, that it is often difficult to discover the direction in which a fracture runs.

2. We must often, therefore, be uncertain whether the bones are rightly replaced or not; for where the course of a fracture cannot be ascertained, we can never be sure whether this is rightly done or not.

3. But even where the reduction of the fracture can be accomplished, we know from daily observation that it is difficult

to retain the different parts of the bone in their situation with such exactness as to prevent deformity. For when the fracture is either in the neck of the bone, or runs obliquely in any other part of it, it is so difficult to prevent the fractured parts of it from being displaced merely by the ordinary action of the muscles, that the limb for the most part becomes much shorter than the other; for in all such cases, if the different parts of the bone cannot be so placed and retained as to support each other, the under-part of it will very certainly be drawn upwards.

In all these fractures too, other causes concur to render it difficult to retain the fractured parts of the bone in their situation. They are more easily acted upon than fractures of other bones by every exertion of the body; particularly by sneezing, coughing, and laughing; nor can the posture of the body be in any way altered without moving the thigh.

Till of late, practitioners were often disappointed in their endeavours to re-

duce fractures of the femur ; chiefly owing to the position in which the limb was put during the operation. The body being placed either upon the floor, on a table, or in a bed, the limb was then extended, by which all the muscles of the limb were put upon the stretch ; and as the extension was continued till the different parts of the bone were replaced, when this was difficult, the muscles were often either violently torn asunder, or so much weakened as not to be afterwards fit for use ; for some of the muscles of the thigh being among the strongest of the body, a very considerable force was required to overcome their resistance. But if the muscles of the limb are relaxed, by making the thigh form an obtuse angle with the body while the joint of the knee is moderately bent, it is surprising with what ease we may, in most cases, place the fractured end of the bone in its situation. The cause of resistance is thus almost entirely removed ; so that if much tension or swelling have not taken place, the ends of the bone may in general

ral be easily brought in contact, by one assistant securing the upper end of it, while the under part of it is supported and gently drawn down by another, the surgeon in the mean time being employed in putting the fractured parts together with as much accuracy as possible.

Fractures of the neck of this bone are particularly difficult to reduce; for the muscles being here exceedingly strong, and running in various directions, they cannot be relaxed so completely as those in other parts of the limb. But even here we may, for the most part, succeed in the manner I have mentioned, the body being secured by one assistant, while moderate extension is made by another at the under-part of the thigh. Practitioners ought, however, to be provided with instruments for more powerful extension when more lenient measures do not succeed. Different instruments are delineated for this purpose in Plates LXXXVIII. LXXXIX. and XC., but



none of them should ever be employed till other more gentle means have failed.

It is not, however, in replacing the bones, but in retaining them when replaced, that we most frequently fail. In transverse fractures of this bone, the practice is easy. After the fractured ends of it are brought in contact, they would for the most part support each other with sufficient firmness even without a bandage, if the patient should be confined to a proper posture ; but to prevent any risk from sudden exertions, the parts should be as firmly secured with splints and a proper bandage, as is consistent with a free circulation through the rest of the limb.

For this purpose two splints are represented in Plate LXXXI. fig. 4. and 6. One to reach from the top of the hip-joint to a little below the knee, and of a breadth sufficient to cover at least one half of the thigh ; the other to reach from the groin to a little below the knee, and in breadth to cover about a third part of the thigh. Of these, covered with soft flannel, the longest

longest laid upon a twelve-tailed flannel bandage, is to be placed upon a thin pillow nearly as long as the thigh. The patient being previously laid on a firm hair mattress supported by firm spokes of timber, so that the limb may not sink or yield, his knee being moderately bent, and the bones accurately set, the pillow with the bandage and splint above it ought to be placed so that the splint may reach from the hip-joint along the outside of the thigh to the knee. That this posture of the leg and thigh may be easily preserved, the patient should not be laid directly upon his back, but turned somewhat towards the injured side; and the knee and leg raised rather higher than his body.

The limb being thus placed in the posture in which it is to be kept, the short splint mentioned above must be laid along the inside of the thigh from the groin to the knee, when the twelve-tailed bandage, previously placed beneath the other splint, must be applied with such tightness

as

in one posture for six or eight weeks, as is too frequently done, is very apt to become stiff and unwieldy, so as afterwards to give much uneasiness and distress. In a simple fracture, the patient may, at the end of a fortnight, be allowed to turn more towards his back, and the joint of the knee may be somewhat stretched out. If this is done with caution, it may be repeated daily; that is, the leg may be alternately stretched out and bent; by which the motion of the whole limb will be much more free and entire at the end of the cure than we usually find it to be: but where the bones of a limb are broken in several parts, and into small pieces, the limb should not be raised nor moved in any manner of way till five or six weeks have elapsed; and then only with much caution.

In a great proportion of cases in which cures are practicable, this course of treatment will prove successful. It will never fail in transverse fractures, if all the parts of it meet with proper attention: But although it will often succeed even where

where the bone is broken obliquely ; yet it must be confessed, that cases sometimes occur in which it fails entirely ; the ends of the bone slip past each other, and the limb becomes much shorter than it ought to be, notwithstanding all our efforts to prevent it.

An effectual method, indeed, of securing oblique fractures in the bones of the extremities, and especially of the thigh bone, is perhaps one of the greatest desiderata in modern surgery. In all ages, the difficulty of this has confessedly been great ; and frequent lameness produced by shortened limbs arising from this cause, evidently shows that we are still deficient in this branch of practice.

The treatment of fractures being one of the most important branches of surgery, and to prevent lameness, one of our first objects, much ingenuity has been shown in the invention of means for answering this purpose : It has been proposed, and by many attempted, in fractures of the thigh, to secure the patient's body, as one fixed point,

point, with different bandages, to the upper part of the bed, and by an axis in peritrochio at the foot of the bed, to make such a degree of extension as might be fully equal to the purpose of retaining the fractured bones. But all who are acquainted with the fretful, irritable state, in which patients with fractures commonly are, and with the pain that tight bandages always excite, will know, that although proposals of this kind may appear to advantage in theoretical disquisitions, they will never probably be of real utility. And accordingly none of them have ever been in general practice.

The invention of the late Mr Gooch of Norwich, is the one that promised to prove most useful in oblique fractures of the thigh. This instrument is delineated in Plate LXXXII., and in an improved state by the late Dr John Aitken in Plate LXXXIII.

A broad firm strap of leather, lined with quilted cotton or soft flannel, is placed on the upper part of the limb, where it is  
firmly

firmly secured with buckles. A similar strap is put round the under part of the thigh, and made to rest chiefly on the condyles of the femur. Two or three steel splints, connected with the straps, pass from one to the other in such a manner, that by means of them the straps can be forced asunder, and retained at any distance during the cure.

For a more particular account of this apparatus, the explanation of the Plates may be consulted.

In some cases, however, the pain, swelling, and inflammation, are so considerable, as to preclude the application of the most simple bandage. After these symptoms are relieved by local blood-letting and other remedies, Mr Gooch's method, or Dr Aitken's, may be adopted where the fractured bones cannot otherwise be retained; if not, the cure must be conducted in the usual way, with the hazard of the ends of the bone passing each other, and of the limb being somewhat



what shortened. But in this event, under the circumstances I have mentioned, although the patient may regret his misfortune, he cannot with justice blame the surgeon.

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## SECTION XIII.

*Of Fractures of the Patella.*

THE patella or knee-pan is liable to fractures from falls and bruises upon the knee. Transverse fractures of this bone are most frequent: We also meet with longitudinal fractures, and in some cases it is broken into three or four different pieces.

In fractures of the patella, we are desired to make a guarded prognosis; for by most writers, it is said, that they almost constantly terminate in a stiff joint, owing, as is supposed, to the callus forming in too great quantity, and finding access to the cavity of the joint. I have not found, however, that fractures of this bone are so apt to produce stiff joints as we are led to expect. In various cases that have fallen

under my care, scarcely any degree of stiffness remained after three or four months had elapsed; nor is it probable, when permanent lameness ensues to fractures of this bone, that it proceeds from superabundance of callus. I rather think that it proceeds from the inflammation that usually takes place; or from the knee being kept too long in an extended immoveable posture. From a dread of separating the fractured parts of the bone before they are firmly united, the leg is usually preserved in an extended posture for eight, or perhaps ten weeks; a much longer period than is necessary, and by which alone even the soundest joint would be apt to become stiff and immoveable.

In the treatment of fractures of this bone, in whatever direction they may run, the leg should be extended, in order to relax the only muscles with which it is connected, those forming the ligament inserted into it. With this view, the patient should be placed upon a bed rendered so firm that it will not yield during the course of  
of

of his confinement ; a precaution highly requisite in all fractures of the lower extremities, where long confinement to bed is almost always necessary, and where unequal sinking of the body is often the source of much uneasiness to the patient, and may even be the cause of separation of the newly replaced bones.

This being done, a long firm splint of timber, thickly covered with soft wool, or with several plies of fine flannel, should be placed beneath the thigh and leg, from the upper part of the one to the extremity of the other ; and to this the limb should be secured by two straps between the ankle and knee, and one or two between the knee and top of the thigh. This will effectually preserve the leg in a state of extension ; and it does it in the easiest manner when the splint is sufficiently broad and properly covered with flannel and wool in the manner I have mentioned.

The different parts of the fractured bone are now to be brought as near together as possible with the hand ; but no

bandage is yet to be applied to them. Our great object at first is to prevent inflammation; for which purpose as much blood should be taken from the joint with leeches as the patient can properly bear; and for two or three days, or as long as much pain, swelling, or tension, continue, saturnine and other astringent applications should be used for removing them.

This being accomplished, we again examine the state of the bone; and if the different parts of it are all either entirely or nearly in contact, they ought not to be disturbed. The joint may be covered with a large pledget of saturnine cerate, by which it will be kept soft and easy; and a hooped frame should be employed to support the bed-clothes.

But if the different parts of the bone, instead of being nearly in contact, are found separated to any considerable extent, we ought first to replace them, and then endeavour to retain them as far as this can be done with bandages.

In

In longitudinal fractures of the patella, this is easily done ; for in this direction we meet with no resistance, and the parts are easily retained by moderate pressure, either with the common uniting bandage, or with slips of leather spread with glue or adhesive plaster. But in transverse fractures of this bone, as that part of it that remains connected with the extensor muscles of the thigh is apt to be drawn forcibly upwards, we cannot always replace it but with a force that would excite pain, swelling and inflammation.

It is not necessary, however, that the different pieces of bone be kept in exact contact. Where it can be easily done, it ought always to be advised ; but I know from the result of several cases where this was impracticable, that a cure may be obtained, and the joint be equally firm and useful as it was before, even although the separated portions of bone cannot be kept within an inch of each other. We should not therefore be anxious about this ; and instead of using much force for

drawing the bones into contact, no more should be employed than the patient can easily bear.

Various bandages have been invented for drawing the divided parts of a fractured knee-pan together; but almost all of them have been formed upon erroneous principles. They are made to press equally upon the upper and under portion of the bone: Whereas the least reflection on the anatomical structure of the parts must render it obvious, that no advantage can be derived from much pressure on the inferior part of the bone, which always remains in its natural situation; and therefore, that our force should be entirely applied to that part of it that remains connected with the ligament of the extensor muscles, by the action of which, particularly of the rectus muscle, this portion of the bone is drawn upwards.

In Plate LXXXIV. a bandage is represented, from which, while it fits easily upon the parts to which it is applied, every advantage may be derived that  
this

this kind of assistance can give: It consists of two circular straps of firm leather, A B, lined with soft flannel, with two perpendicular straps C E, that pass from one end to the other, and a semilunar firm compress G; with another strap of a greater length D, reaching from the point of the toes to the buckle on the upper circular strap round the thigh, as is more particularly represented in fig. 3. of the same plate.

The leg being extended and raised to a proper height for relaxing the extensor muscles of the thigh, the upper edge of the under circular strap A should be applied to the under part of the inferior portion of the bone, so as to support it in its natural situation without forcing it farther up. The strap must be then tightly buckled; and the upper half of the bone being pulled gently though firmly down, the semilunar compress F, in fig. 2. must be applied round the upper end of it, when the upper circular strap must be also buckled. By means of the



two perpendicular straps and buckles, we now make a gradual firm extension, which will not move the under circular strap if it was previously made sufficiently tight; but which will draw the other down if it has not been made too tight. This will, in some degree, draw down the upper part of the bone, by gently pulling the semilunar compress previously applied to the upper part of it; but it will be more effectually done by the strap D made sufficiently tight by fixing it to the corresponding buckle in the upper circular strap B.

In this manner the different parts of the bone may be made to approach each other as far as this can with propriety be done; but for the reasons I have given already, the pressure should never be carried so far as to endanger the excitement of pain, inflammation, or swelling.

The limb being secured in the manner I have mentioned, the bandages should not be removed till the twelfth or fourteenth day, if pain and inflammation do not render a more early removal necessary.

ry. But about this period, the bandage should be removed, when the limb may be moderately bent ; and this being cautiously repeated every second or third day, no interruption will be given to the cure, while the motion of the joint will be preserved ; which it seldom or never is when this piece of attention is omitted.

The joint of the knee is liable to another injury, so similar in its effects, as well as in the method of cure, to fractures of the patella; that I think it right to mention it ; namely, a separation, by external violence, of the ligament or tendon of the rectus muscle from the patella. The usual effect of a smart stroke, or a severe fall, upon the fore-part of the knee, is a fracture of this bone ; but where a person carrying a heavy burden upon his back, falls with his knee much bent, a rupture of the tendon more frequently happens : at least I have met with it in several instances from this cause, in which the tendon, after separating from the bone, retracted to the distance of two or three inches.

The

The treatment that I have advised for a fracture of the patella proves equally successful here; only it will be understood, that in this case no advantage can be obtained from pulling down the retracted tendon: For not being connected with any part of the bone, it cannot be laid hold of; so that we have to trust entirely to the extended posture of the limb. But although the tendon and bone cannot be brought close to each other, yet a cure may always be accomplished in the manner I have mentioned.

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## SECTION XIV.

*Of Fractures of the Bones of the Leg.*

**I**N fractures of the leg, only one bone is often broken ; but a fracture of both is more frequent. In this case the seat, as well as the direction of the fracture, are readily perceived. When one bone only is broken, the nature of the injury is discovered with more difficulty. This, however, is of little importance ; for when one of the bones remains entire, it serves so effectually to support the other, that little more is necessary than confinement till the fractured bone is united.

Fractures are more frequent near the joint of the ankle than in other parts. A great proportion indeed of fractures of the fibula are seated an inch or two above the  
under

under extremity of this bone, this being the weakest part of it.

The same general principles that I have proposed in the management of fractures of the thigh-bone, prove applicable in fractures of the leg: In replacing the bones, the muscles of the limb should be relaxed; and we do it in the most effectual manner by bending the joint of the knee, and slightly extending the foot. The leg being put in this position, the bones are for the most part easily replaced; and with no more extension than can be easily given, by one assistant at the upper end of the limb, and another at the ankle.

This being done, and the patient placed in such a manner that the injured leg may be laid upon its outside, with the knee bent, the splints, figs. 3. 5. or 6. Plate LXXXI. should be applied and retained with the twelve-tailed bandage; the splint on the outside of the leg reaching from a little above the knee to beneath the ankle, with a view to prevent  
the

the motion of either of these joints, by which the bones are very apt to be displaced.

Whether the splints are of firm paste-board, or such as are represented in Plate LXXXI. they would, for the most part, prove sufficient: But when the patient is either restless, or troubled with spasmodic affections of the muscles of his leg, an additional splint of wood, shaped to the form of the leg, represented in fig. 1. and 2. of the same plate, should be applied along the outside of it; and if it is slightly excavated and filled with soft wool or tow, it fits with ease, while it prevents, with certainty, the ends of any of the bones from falling down. We fix it with straps and buckles. and the leg, when dressed in this manner, has the appearance represented in Plate LXXXV. fig. 2.

I have already observed, that after the dressings are applied, the leg should be laid upon its outside, with the knee bent, and the foot supported with a turn of a roller, as represented in the figure just mentioned.

ed. The intention of this is to relax the muscles of the limb ; by which the patient lies with more ease, while the bones are less liable to be displaced, than where the muscles are fully stretched out, as till lately was almost the universal custom.

But although the leg should be placed in such a posture as may tend most effectually to relax the muscles ; yet the knee should not be more bent than this requires : For when this joint is kept long much bent, it proves almost equally irksome to the patient as when the leg is fully stretched out. The knee should not therefore be more bent, nor should the patient be laid more towards his side, than is just necessary for allowing the leg to be placed upon its outside.

Some people, however, cannot sleep when lying on either side ; and some practitioners think, that fractures of the leg heal more easily when the patient is laid on his back, and the limb placed upon the gastrocnemii muscles, with the toes upwards. In such cases the patient may be placed

placed upon his back, and yet the curved position of the leg retained. This may be done in different ways ; but the easiest method is, to raise the leg, and support it upon a frame, at a proper height above the level of the body. This admits of the limb being placed in the posture I have advised, and with any necessary degree of curvature.

Even where a fractured leg is placed on the outside, it proves to be a pleasant variety to have the posture altered ; and with such a frame it can be easily done.

A limb placed in this situation is represented in Plate LXXXVI. fig. 2., and the same variety of posture is admissible in fractures of the thigh. The patient may from the first be placed with his leg curved in this manner ; or he may afterwards turn upon his back, and the cure be completed while he remains in this posture, or he may alternately change from one to the other. The inconvenience usually complained of, from the leg resting upon the heel when stretched out,



out, is avoided by an excavation or opening in the bottom of the frame for receiving the heel, or it may be done by allowing the heel to project over the edge of the frame altogether. No change of posture, however, should be permitted for the first ten or twelve days. About this time the patient may be turned with caution upon his back, and the leg moved from one position to the other, care being taken to preserve it in the same degree of curvature.

In fractures of the leg, where the fibula only is injured, it is apt to pass unnoticed, and to be considered as a sprain of some of the muscles: But as very serious consequences are apt to ensue from this mistake, it ought to be strictly guarded against.

When treating of fractures of the clavicle, I had occasion to mention an appearance which, of itself, is extremely simple and of easy treatment; but which, from want of attention to the cause of it, has often been productive of much perplexity both to patient and practitioners;

I mean what is commonly termed the Rising End of a Bone; and as this frequently occurs in the leg, I think it proper to mention it here.

When the bones of the leg are broken directly across, they sometimes serve to support each other so effectually that neither of them are displaced. In such circumstances, no inequality appears in the limb, if it be not from some temporary swelling of the soft parts. But when both bones are not only fractured but displaced, the under part of them, or that portion connected with the foot, is almost always drawn down, and towards the back part of the leg; by which an unequal prominency is produced by the projecting end of the upper portion of bone, or that part of it which still remains connected with the knee.

It is this that is termed the Rising End of the Bone; and in reducing such fractures, much pains is commonly taken to force this part of the bone into contact with the other. It is obvious, however,

that the upper part of the bone does not rise, but that the inferior portion falls, or is drawn down, and out of its natural situation, by the weight of the foot, as well as by the contraction of the muscles on the back part of the leg: Hence no advantage can be gained by any pressure made upon the superior part of the bone, while much harm is often done by it, by bandages being so tightly tied over it as to cut all the teguments with which it is covered; and thus forming a compound fracture of what otherwise would have remained of the most simple kind.

The upper part of the bone never rises out of its natural situation; so that any inequality in the form and appearance of the leg, must be produced in the manner I have mentioned, namely by the inferior portion of the bones being drawn out of the situation which they ought to occupy: So that instead of forcing down the upper part of the bone, our sole object should be to raise the inferior part of it, so as to bring them into contact; and

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by supporting it in this situation, to endeavour with as much certainty as possible to effect their reunion. In this manner a cure may be often accomplished, which could not be obtained in any other way.

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## SECTION XV.

*Of Fractures of the Bones of the Foot and Toes.*

**F**RACTURES of the bones of the foot and toes are to be managed nearly in the same manner with similar injuries of the hands and fingers. All portions of displaced bone must be put into its natural situation with as much accuracy as possible ; and we endeavour to retain them by splints fitted to the form of the part, supported with different turns of a roller. In fractures of the bones of the foot, a large splint should be applied over the sole, so as to support the whole of it ; and no freedom should be permitted in the motion either of the foot or ankle during the cure ; for nothing tends more to displace a fractured portion of bone than the action of the contiguous muscles.

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## SECTION XVI.

*Of Compound Fractures.*

**A**S the term Compound Fracture has been applied to injuries of different kinds, I think it right to define with precision the meaning that I wish to affix to it. A fracture of a bone, communicating with an external opening or wound in the corresponding teguments, I denominate a compound fracture. It is not the circumstance of a fractured bone being accompanied with a wound in the contiguous soft parts, that constitutes a compound fracture: This may happen with a fracture of the most simple nature. Unless the external opening communicates with the fracture of the bone, the fracture is not affected by it, even although the wound is extensive; while the smallest puncture

passing directly to the substance of a fractured bone, adds difficulty to the method of cure, and hazard to the event.

Compound fractures are produced, not only by external violence, but frequently by the bones in simple fractures being, in the course of the cure, pushed through the corresponding teguments. In some cases, this happens from a bone being so very obliquely fractured that it terminates in a sharp point; while in others it is the evident effect of too tight a bandage, applied with the view, as we have seen in Section XIV., of bearing down the upper end of the fractured bone. But in whatever way a compound fracture is produced, the consequences that result from it are nearly similar. The admission of air to a fracture adds evidently to the risk that attends it; and whether this takes place as an immediate effect of external violence, or as the consequence of pressure upon the ends of the bone, no difference is perceived in the effects that result from it.

Various

Various reasons might be adduced to prove that it is the admission of air alone that renders compound fractures more hazardous than others. I may shortly mention, however, one of the most obvious proofs of it. The worst variety of simple fracture, where the bone is broken in the most oblique manner, and where it is difficult or perhaps impossible to retain it in its situation, will continue to do well, and to excite no severe symptom, as long as the skin remains entire: But if, by any accident, the point of the bone is pushed through the teguments, from that moment the pain becomes more severe; the inflammation, which before perhaps was trifling, becomes now considerable; fever takes place; the limb is apt to be attacked with severe spasmodic twitchings; and to these gangrene or extensive suppurations frequently succeed.

In the treatment of compound fractures, our first object is to restrain profuse hemorrhagies when they take place, by a proper application of the tourniquet:



Our next is to consider, whether we should attempt to save the limb, or recommend immediate amputation.

From the difficult treatment and uncertain event of compound fractures, practitioners have been very universally disposed to consider the amputation of the fractured limb as necessary. At all times indeed individuals have opposed this general opinion. Among others, Mr Bilguer of Berlin wrote decidedly against it; and he asserts, that amputation is seldom or never necessary, and that a greater number of patients would recover if this operation were entirely exploded.

To me it appears that both opinions are in the extreme; and that they have been formed without that attention to the discrimination of circumstances which the great importance of the question merits.

In private practice, where patients can be kept quiet and perfectly at rest from the date of the injury, and where due attention can be ensured on the part of the practitioner, as well as of experienced  
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nurses, compound fractures should receive a different treatment from those that happen in a field of battle or in an engagement at sea. So many instances occur, in which, from amputation being objected to by the patient, from the limb being too much swelled or inflamed before assistance is called, or from intention on the part of the practitioner to endeavour to save the limb, of cures being made, that I am now convinced that in private practice immediate amputation should never be advised, unless when the bones are so much shattered that they cannot reunite; or where, from the violence of the injury, the texture of the soft parts is completely destroyed.

On the other hand, I believe, that it would be a good general rule, both in the navy and army, to amputate immediately in all cases of compound fracture that occur in battle, where the accident is either in the humerus or thigh, or where both bones of the fore-arm or leg are fractured. In this situation, the patient  
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servation. Of those who have died soon after the operation, either from the fever induced by the extensive wound ; from the great and sudden change produced in the circulating system by the removal of a limb ; or from the perturbation and violent agitation of spirits which the unexpected loss of a limb must always induce, a great proportion has been of those on whom the operation was performed immediately after the accident : A patient in this state of body and mind must be ill-fitted for undergoing the severity of such an important operation ; and accordingly all the causes that I have enumerated concur to render the subsequent fever, and every concomitant symptom, more violent than we commonly find them in patients who have been reduced by confinement and a low regimen, and who, from having full leisure to reflect upon the danger of their situation, are, from their own conviction of the necessity of the measure, very readily induced to submit to the operation.

A patient may indeed be brought so low as to make the success of the operation doubtful from this cause alone : . . . But a practitioner may always guard against this, by proposing the operation as soon as his attempts to save the limb prove abortive, and before the patient's strength has declined too much.

Amputation seems to prove more successful in the more advanced stages of compound fractures than immediately after the accident ; and still more so in the advanced stages of chronic affections, particularly in white swellings of the joints, as I have elsewhere remarked, than in the more early periods of the disease. A point of the greatest practical importance is thus offered to our consideration. So far as my observation goes, I consider the fact as ascertained ; and if the experience of others leads to the same conclusion, it will prove the most convincing argument against early amputation. In the course of my own experience, I do not recollect an instance of death having ensued from  
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the operation alone, where the disease was of some duration for which it was advised ; and it has often been performed where the patient was greatly exhausted : Whereas many have died merely from the operation, where it has been put in practice soon after the accident. When I speak of death as the consequence of the operation, I do not mean such instances of it as occur from hemorrhagies breaking out in the course of a short time after the patient is laid in bed, as these commonly happen from negligence on the part of the surgeon, at whatever period a limb may be amputated ; but such as take place about the second or third day, and in some instances at a later period, from the violence of the fever induced by and commencing soon after the operation.

When amputation is not performed immediately, or soon after the injury is received, all practitioners agree that it cannot, for several days at least, and often for a much longer period, be admissible.

Different

Different causes may afterwards render it necessary.

1. Hemorrhagies under certain circumstances.

2. Extensive mortification.

3. The ends of the fractured bones remaining long disunited, while a copious discharge of matter endangers the strength of the patient.

When hemorrhagies take place immediately, we have it always in our power to command them, either by compression alone, or by enlarging the wound when it is too small, and securing the bleeding arteries with ligatures. Sometimes, however, when no discharge of importance occurs at first, profuse hemorrhagies will take place at the end of several days. It may be difficult in some cases to account for this; but we can frequently trace it to the effect of friction; the coats of an artery being destroyed by beating or rubbing upon the sharp edge of a splintered bone.

Even

Even in this advanced state of the injury, we may frequently be able to secure the wounded arteries with ligatures. But the limb is sometimes so much swelled and inflamed before the hemorrhagy appears, that the original opening will not admit of this; and on proceeding to enlarge it, such confusion is met with from effused coagulated blood between the interstices of the muscles, as well as through the whole cellular membrane of the affected parts, that the divided arteries cannot be all brought into view, but by such extensive incisions as in this state of the parts would create more hazard than amputating the limb at a proper distance above. And although it is not frequent, yet instances happen, where the most expert surgeons are obliged in this situation to amputate.

Mortification is perhaps the most urgent motive for amputating in this stage of compound fractures. I shall have occasion, however, to consider this subject more particularly in the chapter on amputation;

putation ; and with respect to the third cause that I have mentioned, no reunion taking place between the fractured parts of the bone, and a sinking of the patient's strength from too copious a discharge of matter, no practitioner of experience will, in this situation, dispute the propriety of amputation.

It is this state of a compound fracture, when the original inflammatory fever excited by the injury is gone, and before the patient is too much weakened by the discharge, which of all others I consider as the most favourable for amputation. The exact time cannot possibly be fixed by any general observation : It must depend upon the particular circumstances of every case, and chiefly upon the quantity of the discharge, and strength of the patient ; and these again are points which the judgment of the practitioner in attendance can alone decide upon. I may remark, however, that, as long as the patient does not seem to be much hurt by the discharge, however great it may

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be, the operation should not be advised; for, while his strength is not much impaired, we may with safety proceed in our endeavours to save the limb.

From what has been said, it will appear, that in private practice, very few cases can occur of compound fractures, in which we should not attempt to save the limbs.

In the treatment of compound fractures, our object is the same as in the management of those of the most simple nature; namely, to replace the bones that may be deranged, and to retain them till they are united.

In the first place, all extraneous bodies should be removed, as well as all those small pieces of bone that will not probably unite with the rest; for which purpose, the opening, if too small to admit of their being easily taken out, should be enlarged with a scalpel. And this being done, we in general find, that the bones are easily replaced by relaxing all the muscles of the limb in the manner already pointed out in the preceding sections

tions of this chapter. Only one exception occurs to this: A sharp point of a bone is, in some instances, so far pushed through the teguments, that it cannot be replaced by an ordinary force; and to a certain extent, the greater the force is that we apply, the more firmly the protruded portion of bone is fixed between the skin and parts beneath. In this situation, we should either saw off the end of the protruded portion of bone, or enlarge the wound.

When a long sharp point of bone is much protruded, we should not hesitate to remove it; for, although it might be reduced, it would not readily unite with the rest of the bone, at the same time that it would be apt to excite much pain and irritation. When the portion to be taken away is small, it may be done with the cutting forceps usually employed in amputations: But, when it cannot be easily done in this manner, it may with safety be taken off with a saw; a piece of pasteboard, or thin sheet-lead being previ-

ously inserted between it and the teguments beneath.

But when the protruded portion of bone is broad at the base, and not of great length, as there will be cause to hope that it may unite with the rest of the bone if the corresponding parts are brought in contact, we ought certainly to endeavour to save it; and in general we are able to do so by enlarging the opening through which it has passed. If we take care to avoid any large bloodvessels and nerves, which those acquainted with the anatomy of the parts will readily do, no danger will occur from the operation. Instead of increasing the danger of the patient, it tends often to lessen it, by removing a powerful cause of pain and irritation, and thus preventing that inflammatory tension to which limbs in this situation are particularly liable.

To those not accustomed to manage compound fractures in this manner, the practice that I now recommend may be supposed to be attended with hazard; and  
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to convert a small puncture into an extensive wound, may often appear to be cruel and unnecessary. But as the admission of air has already occasioned all the mischief that can arise from this, we do not in this manner add to the hazard of the patient; and it is generally well known, that a free incised wound heals more readily than a small puncture. It is the skin only that for the most part we have to cut here; but even where the bone cannot be easily reduced without carrying the incision into the substance of the contiguous muscles, we should not hesitate to advise it: Only, in this case, the opening should be made as much as possible in the direction of the fibres of the muscles.

The splinters of bone, coagulated blood, and other extraneous bodies being removed, any artery that may be cut being secured with a ligature, and the protruded portion of bone replaced, the fracture is, in other respects, to be reduced in the manner I have advised when speaking of simple fractures; that is, by relax-

ing the muscles of the limb, and extending the bones no more than is just necessary. This being done, a pledget of soft lint, spread with any emollient ointment, should be laid over the wound, when the limb should be placed upon a firm splint, and still kept in a relaxed posture. As it is of much importance that the wound be regularly dressed without moving the limb, it should, if possible, be so placed, that this can be done; and with the same view, the twelve-tailed bandage, in compound fractures of the extremities, should be preferred to the roller.

As it is a point of the utmost importance to place the limb in such a posture as will admit of the fore being dressed without being moved, various inventions have been proposed for rendering this in every case practicable. Few of these, however, have answered the purpose for which they were intended. The best that I have seen is a box invented by the late ingenious Mr James Rae of this place; of which, with some improvements made

made by his son Mr John Rae, I now give a delineation. The leg may be laid in it either bent or straight, and a wound, wherever situated, may be dressed without altering the position of the limb, as will be more clearly understood from the representation of the instrument, Plate LXXXIII. fig. 3.

In whatever situation the limb is placed, it is an object of the first importance to endeavour to prevent inflammation; for, when mortification ensues, it may be almost always traced to a high degree of inflammation; and to this also may be traced those extensive collections of matter which often occur in compound fractures. We are, therefore, from the first, to guard against the accession of this symptom; by one or more general blood-lettings, proportioned to the strength of the patient; by the application of leeches to the edges of the sore; by the use of opiates; by gentle laxatives; a low regimen; and other parts of an antiphlogistic course. The dressings should be re-

moved once or twice daily, according to the quantity of matter; and instead of dry lint, pledgets of any emollient ointment, or Goulard's cerate, should be preferred; for I have not found in any state of these sores that ointments do harm; and they always sit easily, and are more easily removed than when dry lint is applied alone.

Warm emollient poultices are commonly applied at first, and continued for a good many days; but as they prove always troublesome, and cannot be removed without in some degree altering the posture of the limb, I think it better to avoid them till we see whether or not they become necessary by the approach of inflammation. In that event, they should be immediately employed as the surest means of exciting a discharge of matter: For, although we would rather wish the sore to heal by what is termed the First Intention, without the formation of matter; yet this being a rare occurrence in wounds attending compound fractures, and

a plentiful discharge of good pus being the most certain preventive of mortification, we should not hesitate in our endeavours to promote it whenever the inflammation becomes severe.

As soon, however, as our views are accomplished, by the inflammation subsiding, and a free discharge of matter having taken place, the poultices should be laid aside : for when too long continued, they certainly do harm, by relaxing the parts too much, and exciting too profuse a discharge.

When matter is discharged from compound fractures in too great abundance, besides laying aside the use of emollient poultices, the sore should be dressed with astringents, such as soft lint dipped in a solution of *saccharum saturni*, with a due proportion of brandy ; and the patient should be supported with nourishing food, a free use of wine, Peruvian bark, and elixir of vitriol. A free vent should be procured for the matter ; and when this cannot be obtained by the posture of the limb,



limb, it should be done by making a counter opening in a more depending part. The necessity, however, of this, may be often prevented by employing soft lint, or covering the sore with soft sponge to absorb the matter, and by frequent dressings; for, although the sores should never be more exposed to the air than is necessary, yet whenever the discharge is copious, there will be more risk from allowing the parts to be long immersed in matter, than from a frequent renewal of the dressings.

When the discharge from compound fractures is excessive, and cannot be lessened by the means I have mentioned, it will often be found to proceed from a portion of loose bone that has not been earlier noticed. In this situation, we should examine the sore with as much attention as possible; and wherever a piece of loose bone is discovered, it ought to be taken out either at the sore itself, or by a counter opening, if it appears that in this manner it can be more easily done. In making  
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an examination for this purpose, the finger alone should be employed when the opening is so large as to give it access; for in this manner we do less harm than with a probe; and at the same time we discover the real state of the parts with more precision. When it is necessary to use a probe, it should be done with caution, for much mischief is frequently done where probes are used with freedom.

If, instead of producing a discharge of matter, the inflammation should end in gangrene, the hazard becomes still greater than it ever can be from the most extensive abscess. Having already in Chapter I. considered the subject of gangrene, I must now refer to that part of the work. In a following chapter, I shall have an opportunity of mentioning the period at which amputation of limbs, attacked with gangrene, should be advised.

In considering this subject, some will suppose that I should have given more particular directions for securing fractured limbs in their situation, especially in compound  
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compound fracture; but, as I know of no method of effecting this with such certainty and ease as the one that I have described, I consider it as unnecessary to enumerate all the means that have been proposed for it. In particular circumstances, those that I have described in the eleventh section of this chapter, the machines of Mr Gooch, and Dr Aitken, may prove useful for keeping the fractured bones extended; and much advantage may certainly be derived from them in giving a steady support to fractured limbs, when it is necessary to move a patient from one part to another: But in common practice, I can without hesitation say, that no advantage is derived from any instrument of this kind that I have ever known used; and few, I believe, have paid more attention to this branch of business than I have often had occasion to do.

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CHAPTER XL.

*Of LUXATIONS.*

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SECTION I.

*General Remarks on Luxations.*

**A** BONE is said to be luxated where that part of it forming a joint is displaced. When the end of a bone is forced entirely out of its corresponding cavity, the dislocation is said to be Complete ; and we term it incomplete, where  
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any part of the bone rests upon the edge of the socket.

Luxations may, with the same propriety as fractures, be divided into simple and compound. Where the end of a bone is merely displaced, we term it a Simple Luxation; but where this is accompanied with a corresponding wound in the soft parts, laying open the cavity of a joint, we say that the Luxation is Compound. By some practitioners the term Compound is applied to dislocations accompanied with fractures of the contiguous bones, whether the teguments be injured or not. We say, however, with more propriety, that a luxation in such circumstances is of a Complicated Nature.

For the most part luxations are produced by external violence, and appear as the immediate consequences of some considerable force applied to the injured parts. They are particularly apt to occur in leaping and falling; from blows, and from violent twists and distractions of the different bones of a limb: But they are also produced

produced by other causes ; by a morbid weakness or relaxation of the ligaments and muscles of a joint, which sometimes occur as the consequences of palsy and long-continued rheumatism ; and by the end of a bone being pushed from the cavity in which it was lodged, by matter collected in it, or by tumors and exostoses.

Dislocations produced by external violence, are chiefly the objects of surgery. The symptoms usually induced by these, are, inability to move the injured limb ; pain, tension, and deformity in the part affected ; and in some cases inflammation, subfultus tendinum, and fever.

In general, the motion of the limb is impaired in proportion to the extent of the luxation ; but in some cases, even the most partial luxation renders the joint perfectly stiff and immoveable, and creates the most exquisite pain on every attempt to move it. This is particularly the case in partial dislocations of the large joints.

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The deformed or altered appearance of a joint, with which luxations are always accompanied, must necessarily be in proportion to the extent of the injury ; but this is not the case with the other symptoms: For *subfultus tendinum*, inflammation and fever, are often excited in a greater degree by partial dislocations, where the ends of bones are not much moved from their situation, than where they are entirely forced from their sockets, owing to a circumstance that we shall presently endeavour to explain.

The first approach of swelling in dislocation, is always of the inflammatory kind, and it is a necessary effect of the violence done to the injured parts. This, however, should be distinguished from a secondary swelling to which dislocations are liable, an extensive tumefaction that in some cases spreads over all the under part of the limb, and which seems to originate from a different cause. Instead of being red, tense, and painful, the teguments are pale, soft, and œdematous ; owing,  
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ing, I suppose, to the lymphatic vessels of the limb being compressed by the end of the displaced bone. This kind of swelling is most frequent in dislocations of the femur and humerus; in which also considerable numbness or diminished sensibility is apt to take place from the compression of the nerves of the limb.

It is of much importance to distinguish dislocations from other affections of the joints, and to ascertain to what extent the bones are moved from their situation. In compound luxations the nature of the injury is obvious; and, for the most part, it is sufficiently evident where bones are completely dislocated; but partial dislocations are often not to be discovered but by the most minute examination: They therefore frequently pass unnoticed, or are considered as sprains, and contusions; and thus, where, with due attention on the part of the practitioner, a cure might frequently be performed, patients are often rendered lame and miserable for life.



The symptoms that I have enumerated are common to all dislocations. In speaking of particular luxations, I shall have occasion to mention the peculiarities of each, and I shall endeavour to do it in such a manner as may with most certainty prevent those unfortunate occurrences to which I allude.

In forming a prognosis of the event of luxations, that is, of the practicability of their reduction, and of the termination of the symptoms with which they are attended, various circumstances require attention: The form and structure of the different joints; the nature and extent of the luxation, together with the degree of violence by which it was produced, and the circumstances with which it may be complicated; and, lastly, the duration of the injury.

The skeleton is commonly had recourse to for a knowledge of the joints; but although every student should be acquainted with the articulations in a dry state, we should by no means rest satisfied

fied with this. In the treatment of luxations, it is much more necessary to have an exact knowledge of the joints in a recent state; of the cartilages, ligaments, and tendons, with which the bones are connected, as well as of the contiguous parts in which the heads of the displaced bones may happen to be lodged: Otherwise our ideas of the nature of these injuries, and of the means that will most probably prove successful in the reduction of displaced bones, must be very imperfect.

I cannot here enter upon a minute description of every joint, as it would lead to an extent of discussion inconsistent with the nature of this work. Referring to the proper sources for more particular information, I shall here only observe, that it is chiefly those joints that are possessed of much motion in which we meet with luxations. Of these, there are two varieties. The one termed the Junction by Ball and Socket, where the head or end of one bone is received into the cavity of another; and

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the other termed by anatomists *Ginglimus*, or the *Hinge-like Joint*, from its resemblance to the hinge of a door. In this the joint is formed by different parts of one bone being received into cavities or indentations of another. The former admits of the most extensive motion, as is exemplified in the joint of the humerus with the scapula, and in that of the femur with the ossa innominata; while the latter does not admit of more than that of flexion and extension, as is the case in the elbow and knee. In these we accordingly find, that this more limited motion to which they are confined, renders them less liable to luxations; while the free motion of the others exposes them to be frequently luxated, as is more particularly the case in the joint of the humerus, from the cavity in which the head of that bone is lodged being of no great depth.

Besides the usual coverings of teguments, muscles, and tendons, in common to joints with the rest of the body, every  
joint

Joint possessed of much motion is provided with what is termed a Capsular Ligament; which is a firm somewhat elastic substance, forming a kind of pouch or bag, that completely surrounds the articulation, and serves at the same time to retain the ends of the bones together, and to contain a thin transparent fluid, the synovia, for the purpose of lubricating the cartilages that cover the ends of the bones.

Practitioners are not agreed whether in luxations the capsular ligaments of joints are ruptured or not. As it has appeared on dissection, in a few instances, that the ligament was ruptured, some have concluded that it is the case in all; while others are of opinion, that the ligament always remains entire, except where the luxation has been the consequence of very severe and unusual degrees of violence.

The result of my observation on this point is, and I speak from many opportunities of dissecting dislocated joints after death, that partial luxations may happen

without any rupture of the capsular ligament; but that it is always ruptured in complete luxations produced by external violence; nay, that the ligament is often torn from its insertion round the neck of the bone. Where the head of a bone is gradually pushed from its socket by the slow formation of a tumor within the joint, and where the ligament is perhaps much relaxed by disease, a luxation may happen without either rupture or laceration: But we cannot suppose that such a firm substance as a ligament in a state of health always is, will, without bursting, yield to the sudden impulse produced by the complete dislocation of the head of a bone, and where the displaced bone is in some cases almost instantaneously forced to the distance of several inches from its natural situation. Different instances are upon record of this opinion being supported by the dissection of dislocated joints after death; and were it necessary, I could add several others that have fallen within my own observation.

I mentioned above, that the pain attending partial dislocations is commonly very severe on every attempt to move the joints. For the most part, indeed, it is more exquisite than it usually is where the luxation is complete; and we conclude that it proceeds from the capsular ligament being overstretched, and from the ends of the displaced bones continuing to act against it instead of passing freely through it.

In judging of a luxation, the distance to which the head of the displaced bone is forced, and the degree of violence by which it was produced, require particular attention. When a bone is only partially dislocated, although the pain may be very acute, yet the reduction will be accomplished both with more ease and certainty than if the same bone had been forced completely out of its situation. And where the joint has not suffered any extraordinary violence, the inflammation and other concomitant symptoms will not prove so formidable as they commonly do

where the capsular ligament and other soft parts have been much stretched, or otherwise severely injured.

One of the most unfavourable circumstances with which a luxation is ever attended, is a fracture of one or both of the bones forming the joint. Even a fracture of the displaced bone proves always distressful, especially if it is broken near to its neck, as in this case it can scarcely be laid hold of for the purpose of reducing it; but the risk attending it is much greater when the bone forming the socket into which it should be received is also broken: For we know from experience, that fractures of these parts are more apt to excite severe degrees of inflammation, as well as extensive suppurations, than fractures of any of the long bones. And when the socket is broken, there is always much hazard of the joint being rendered stiff for life, even when the reduction of the displaced bone is accomplished in the easiest manner.

A

A dislocation being more or less recent, is the next point that merits attention; for we know that luxated bones are, *cæteris paribus*, more easily reduced soon after being displaced than when much time has elapsed. While the injury is recent, the bone returns with more ease along the parts which it has just traversed, than it possibly can do after lodging several weeks or months among the contiguous muscles; where the head of it, instead of being loose, as is usually the case at first, forms a socket for itself, and is commonly firmly grasped by some of those muscular fibres with which it is surrounded. At this period too, the cavity from whence it was dislodged may probably be in some degree filled up by the contiguous soft parts: Not that the synovia ever becomes inspissated, so as to produce this effect; for although this has by many been supposed to happen, and various means have been proposed for preventing and removing it, yet we now know that the opinion is ill-founded. No inspissation of this fluid  
has



has ever been discovered by dissection, although stiff joints, where this state of the synovia was previously considered as the cause, have often been laid open for the purpose. But although the cavity of a joint may not be filled up by the effect of any particular affection of the synovia, there is much reason to suppose, that in course of time it will be diminished by the constant action of the contiguous muscles; which will not only force the cellular substance, fat, and other soft parts with which it is covered, into it, but may even have some effect in compressing the bone itself, or the cartilaginous brim with which the bone is usually covered.

These are the circumstances in dislocations which more particularly require attention; but we have also to remark, that the patient's age and general state of health, have some influence in the reduction of a dislocated bone. Dislocations are more easily reduced at some ages, and in particular habits of body, than in others. Thus, in advanced periods of life,  
and

and in weak delicate constitutions, where the muscles give little resistance, displaced bones are more easily moved than in the vigour of youth, and in robust habits of body, where the superior strength of the muscles has a considerable effect in preventing it.

In the treatment of dislocations, the objects we have in view are, to put the bone that is displaced into its natural situation, with as much ease and expedition as possible; to retain it in this situation till the injured parts have recovered their tone; and to obviate pain, inflammation, and any other symptom that requires attention.

Before proceeding to the reduction of dislocations, we should examine the contiguous soft parts, to see whether they are in a fit state for it or not; for although the sooner the operation is attempted, the more certain will our success in general be; yet whenever the surrounding teguments and muscles are much contused and inflamed, it is better to allow the pain and swelling

swelling to subside before we endeavour to reduce the bone; at least I have always been in the practice of this. I never observed that any bad consequences ensued from it; and I have known much mischief done by a limb being stretched while the parts surrounding a dislocated joint have been much swelled and inflamed.

In such circumstances, therefore, we should endeavour, by local blood-letting with leeches, by the use of saturnine applications, a low regimen, and putting the limb in an easy relaxed posture, to remove the inflammation before any attempt is made for reducing the bone.

In almost every dislocation, one bone only is displaced: The other bone or bones of which the joint is formed remain in their natural situation; and it will be found perhaps universally, that it is the bone connected with the inferior part of a limb that is forced from its situation; the bone forming the upper part of the joint, if it be not fractured, being seldom in any respect altered: In the reduction therefore

therefore of luxations, the only attention to be given to the upper part of a limb, is to keep it firm and steady, while we endeavour by the easiest and most effectual means to replace the inferior part of it.

A person not acquainted with anatomy, might be led to suppose that this may always be readily done; as he will be apt to conclude, that the same degree of force by which a bone is pushed out of its place, will with equal ease replace it. This would no doubt be the case, were it the bone only upon which we had to act, or if the bone was connected with inorganic matter only that would not resist the means employed to reduce it: But every joint being either partly surrounded by, or much connected with muscles, the contractile power with which these are endowed, acts with much force and advantage against every attempt that can be made for the reduction of the bone; for they not only draw it beyond the end of the contiguous bone against which it ought to be placed, but they often pull it

it, out of its natural direction, and fix it firmly in some neighbouring cavity, from whence it is dislodged with difficulty; while the stimulus created by every trial that is made for replacing the bone, is apt to excite a further exertion of the muscles, and to increase the difficulty of the reduction.

It is therefore obvious, that in the reduction of every dislocated bone, the muscles with which it is connected should be put as much as possible into a state of relaxation; for in this situation, the resistance which they give to the force employed for moving the bone is inconsiderable, when compared with what is required for the same purpose, when they are kept in a state of extension. In the one, it is usually done with ease, both to the patient and surgeon; while in the other, that is, while a limb is much stretched or extended, it is with the utmost difficulty that a dislocated bone can be moved.

By relaxing all the muscles of a limb, we may in general obtain a sufficient  
force

force for reducing a luxation merely by the hands of assistants ; but in some instances more force is required than can be applied in this manner : In this case, various instruments have been proposed for increasing our powers of extension ; some of which, and perhaps the most useful, are delineated in Plates LXXXVIII. LXXXIX. and XC.

But whether we find it necessary to use machines of this kind or not, no more force should be ever employed than is just requisite ; and it ought always to be applied in a slow gradual way, by which there is much less risk of any harm being done, than when the muscles of a limb are forcibly and suddenly stretched : And it will also be understood, that the whole force used for the reduction of a dislocated bone, should be applied to that bone only, and not to any other part of the limb.

Besides the resistance arising from the action of the muscles, we sometimes meet with much difficulty from the projecting  
end

end of a dislocated bone having passed that of a contiguous bone. In this case the extension is to be made in such a direction as will best obviate this relative situation of the parts.

In extending a limb for the purpose of reducing dislocations, the extension should be carried so far as to dislodge the displaced bone, and to bring the end of it on a line with the end of the other to which it is to be opposed; otherwise no advantage will be gained by the operation; for while any part of one bone projects past the extremity of the other, no means that we can employ will be able to replace it, unless such a force is made use of, (as has sometimes happened), as is sufficient for breaking off the projecting part of the bone; while, on the contrary, the reduction is always accomplished in the easiest manner, as soon as the displaced bone is drawn freely past all the projecting parts of the other: Nay, when the end of a displaced bone is brought to this situation, it would be difficult to prevent it from passing.

ing instantaneously into its natural situation; so that in the reduction of dislocations, our chief object is to make a sufficient degree of extension, when the ordinary action of the muscles will for the most part replace the bone: Or when this fails, the most gentle pressure will prove sufficient.

The dislocated bone being reduced, it seldom proves difficult to retain it in its situation, unless it has often been displaced before: The surest means of retaining it, is to put the limb into a relaxed posture, and to support the bone that has been just replaced with a proper bandage, till the surrounding soft parts have recovered their natural tone.

The symptoms that prove most urgent in dislocations, both before and after the bones have been reduced, are, pain, inflammation, and swelling. For the most part these symptoms abate soon after the reduction; but while any degree of inflammation continues, repeated applications of leeches should be advised as the



most effectual remedy : And as this symptom is to be considered as the cause of all the others, as well as of those chronic pains to which joints are liable, that have ever been dislocated, it therefore merits particular attention. But this subject having already been fully considered, when treating of contusions, I must now refer to what was then said upon it in Chapter II. Section II.

In the first part of this Section, I have said, that luxations are sometimes combined with fractures of the displaced bones. When a bone is fractured at a considerable distance from the luxated joint, we may for the most part be able to reduce the luxation immediately ; and this being done, the fracture should be treated in the usual way : But when a bone is fractured so near to the luxated joint that it cannot be laid hold of, the case is thereby rendered both difficult and uncertain. In the smaller joints, as in those of the fingers and toes, the displaced portion of bone may in some instances  
be

be pushed into its situation ; but in all the larger joints, particularly in the hip-joint, and in that of the shoulder, we must first allow the fracture to heal, and the union of the fractured bones to be perfectly firm, before we can expect to reduce the luxation.

In compound luxations, that is, where joints are not only luxated but laid open by external injuries, the treatment that I have advised in compound fractures applies with equal propriety : Almost all the observations indeed that were made upon the one will apply with nearly equal force to the other : So that at present I shall refer to Section XV. of the last Chapter, where the subject was fully considered.

I may just shortly observe, that after the luxated bones are replaced, and the limb laid in a proper posture, our next object is to prevent inflammation : This we do with most certainty by copious blood-letting, with leeches applied near to the injured parts ; dressing the sores with sa-

turnine cerate, or any mild ointment ; moderating the pain with adequate doses of opiates ; and a low regimen.

This being done, we have to endeavour to prevent the matter of the fore from lodging about the joint, by placing the limb in such a manner that it may most readily run off: If this fails, we sometimes succeed by dressing the fore more frequently, and absorbing the matter with a bit of sponge ; or, when the quantity of matter is considerable, by a counter opening made in a more depending part of the limb.

When mortification takes place, it is to be treated in the manner I have advised in Chapter I. Section IV.

All that I have hitherto said, relates in general to luxations produced by external violence. When they proceed from the heads of bones being pushed from their sockets, either by tumors of a fleshy or osseous nature, or by collections of matter, they may almost in every instance be considered as incurable: When the joint  
is

is so situated that the diseased parts can all be removed, this measure should be advised ; but when this cannot be completely accomplished, all that art should attempt is, to give as free a discharge as possible to any matter that may form, and to support the constitution with such a diet, as may prevent it from being too much reduced by the discharge.

Dislocations are sometimes the consequence of relaxation of the ligaments and tendons by which the bones in a healthy state are kept together. This relaxation is seldom so completely removed as to prevent the bones from falling out from time to time ; but the inconveniency may in some measure be obviated by supporting the limb with a bandage ; by endeavouring to restore the tone of the relaxed parts by cold bathing ; and, in some instances, electricity has appeared to prove useful.

We shall now proceed to speak of dislocations from external violence as they occur in particular parts.

## SECTION II.

*Of Luxations of the Bones of the Cranium.*

**T**HE bones of the cranium are frequently separated from each other at the futures in hydrocephalus internus. This, however, can seldom become an object of surgery. If such collections shall ever be removed by medicine, all that art can do further is to support the parts with a bandage.

We also find that openings are in some instances produced at the futures by external violence, particularly by falls from heights. This, however, very commonly proves fatal. I have only met with one instance of a patient under such circumstances recovering. All that in this situation can with propriety be done, is to  
support

support the parts by gentle pressure with a proper bandage ; to prescribe blood-letting and other evacuations according to the violence of the symptoms ; and to keep the patient quiet, and under proper confinement during the cure.

## SECTION III.

*Of Luxations of the Bones of the Nose.*

**T**HE bones of the nose are so firmly united, and serve so effectually to support each other, that they are not often dislocated.

These bones being thinly covered with soft parts, luxations in any part of the nose are easily discovered by the touch, as well as by the deformity which they produce.

In the reduction of luxations of these bones, the patient should be seated opposite to a proper light, with an assistant behind supporting his head; and the surgeon standing before, should endeavour to replace the bones with as much accuracy as possible. In general, this may be done

done with the fingers alone; but when one of the bones is pushed inwards, we do it more easily by pushing one of the tubes in Plate XXX. fig. 2. up the corresponding nostril, in order to elevate the depressed piece; and if the tube is guarded with some plies of soft lint, it may be retained in its situation till there is no longer any risk of the bone slipping out.

When either of the bones of the nose is pushed outwards, it must first be exactly replaced, and afterwards retained in its situation by a proper application of a double-headed roller.



## SECTION IV.

*Of Luxations of the Lower Jaw.*

**T**HE lower jaw is connected by a very beautiful mechanism with the bones of the head. In each temporal bone there is an irregular oblong cavity, immediately before the external meatus auditorius. In these cavities, the two condyles of the lower jaw are lodged; and by means of two intermediate loose cartilages which move along with the condyles, and which correspond with the irregular surfaces of the cavities in which they are placed, such a degree of firmness is given to this joint as would otherwise be inconsistent with the freedom of motion of which it is possessed; for although the condyles of the jaw are secured

cured in their situation, by different ligaments, as well as by strong muscles, particularly by the strong tendons of the temporal muscles inserted into the coronoid processes of the jaw; yet the variety of motions which the under jaw is constantly performing, would render it very liable to dislocations, were it not for the intervention of these moveable cartilages; which admit of every necessary freedom, while such a loose, extensive motion is prevented, as must have happened if the heads of the condyles had been placed in large smooth cavities without these cartilages between them.

The under jaw cannot be dislocated either upwards, backwards, or laterally: It can only be dislocated forward and downward. In every other direction, the condyles are so much surrounded with bone, that they cannot be forced out of their corresponding cavities, as will be readily seen on an examination of the skeleton: But when the mouth is widely opened, as happens in yawning, the condyles

dyles are apt to slip too far over the anterior boundaries of these cavities. In this manner a dislocation takes place, as we discover by the chin being thrown forward and downward, while the mouth remains open, at the same time that much pain is produced by every attempt to close it; nor can the patient speak distinctly, or swallow but with much difficulty.

In some cases, one side only of the jaw is dislocated, that is, one of the condyles remains nearly in its natural situation, while the other is thrown entirely out. In this case, the jaw, instead of falling directly down, is pushed obliquely downwards, and somewhat towards the side opposite to that in which it is dislocated.

Besides the symptoms that I have mentioned of pain on any attempt to close the mouth, and difficulty in speaking and swallowing, we are told by all the older writers on this subject, and by all who have copied from them, that luxations of the jaw are apt to induce convulsions, and  
even

even death. I have never, however, met with an instance of this, nor is it probable that it will ever happen, unless from great mismanagement on the part of the surgeon.

A luxation of the jaw being very distressful, and even alarming to those who are not acquainted with its nature, immediate assistance is commonly desired; and with due attention we can seldom fail to reduce it.

The patient being firmly seated on a low chair, with his head properly supported behind, the surgeon standing before, with his thumbs sufficiently guarded, should push them as far as they will go between the teeth of the upper and under jaws, the under or flat part of the thumbs being applied to the surface of the teeth of the under jaw: The palm of each hand should be applied to the outside, while with his fingers he lays a firm hold of the angles of each jaw. With the fingers applied in this manner, he should pull the under jaw forward till he finds it  
move

move somewhat from its situation: And this being done, but not till then, he should press the jaw forcibly down with his thumbs, and moderately backwards with the palms of his hands; when, if the different parts of the operation are rightly managed, the ends of the bone will immediately slip into their situation; upon which the thumbs should be instantly withdrawn.

In general, we are directed to press the jaw downwards and backwards: But although this might succeed in some instances where the jaw is dislocated only on one side, yet even there it would often fail; and it would seldom answer when both condyles are out: For, till the condyles are quite disengaged from the bones on which they rest, and which they can only be by pulling the jaw forward, all the force we could employ in pulling them down would be of little avail, as I have often had occasion to observe.

I have desired, in pressing down the jaw, that at the same time it should be  
pressed

pressed moderately backwards : The slightest force, however, in this direction is sufficient ; nay, in some cases it is not necessary ; for, as soon as the condyles are sufficiently depressed, they are almost instantaneously drawn into their natural situations by the ordinary action of the temporal muscles, whether any force be applied for this purpose or not.

The treatment that I have advised answers equally well, whether the jaw be luxated on one side, or on both ; but where one condyle only is thrown out, the force used for depressing the jaw should be chiefly applied to that side.

The luxated jaw being reduced, the patient should be advised to avoid every cause that might have any effect in throwing out the bone again ; particularly much speaking, gaping, and yawning, as the condyles are apt for a considerable time to be turned out by any of these actions.

In the reduction of a dislocated jaw, the thumbs are very apt to be bit if they be  
not

not well protected, or if they be not instantly withdrawn on the bones slipping into their situation. For the most part, the end of a handkerchief is wrapped round them; but a covering of firm leather answers better, or a case of thin iron covered with leather, would be still preferable, as it would not occupy so much space. It would pass farther into the mouth, and would thus act with more advantage in forcing down the jaw.

S E C.

## SECTION V.

*Of Luxations of the Head.*

**T**HE head is connected in such a manner with the atlas or first vertebra of the neck, that it moves upon it with ease and freedom backwards and forwards, the two condyles of the os occipitis being received into corresponding cavities in the superior oblique processes of that bone: But the lateral and rotatory motion of the head proceeds from the immediate connection between it and the second vertebra of the neck, by means of the processus dentatus of that bone; which passing through the back-part of the large cavity of the atlas, is fixed, by means of different ligaments, to the os occipitis.

The connection between the head and the first of these bones is so firm, that



they are not perhaps ever separated by accident ; at least, I have not heard of any instance of this being discovered on dissection. It rather appears, that, in luxations of the head, the connection is destroyed between the head and the second vertebra, the head being forced with such violence forward as to stretch or rupture the ligaments by which the tooth-like process of this bone is fixed to the occiput : At least, this has been found to be the case in different instances of these dislocations, and it also happens in those who die by hanging.

In every dislocation of the head, the head falls forward upon the breast ; the patient is instantly deprived of sensibility ; he lies as if he were dead ; and he soon dies if the luxation be not quickly reduced. Injuries of this kind are produced most frequently by falls from great heights, or from horseback.

Luxations of the head, for the most part, terminate fatally ; but as instances have occurred where this has been prevented  
when

when timely assistance has been given, we have reason to think, that recoveries would be more frequent if this could be always procured.

Different means have been proposed for the reduction of these luxations ; but whatever requires much preparation is here inadmissible. In all such cases, our views must be instantly carried into effect ; and it fortunately happens, that in perhaps every instance they may be accomplished without any preparation.

The patient being seated on the ground, and supported by an assistant, the surgeon standing behind, should raise the head from the breast ; and the assistant being desired to press down the shoulders, the head should be gradually pulled straight up till the dislocation is reduced ; or, if this does not happen with moderate extension, it may, at the same time, be gently moved from side to side. A sudden noise or crack is heard on the reduction taking place ; and if the patient be not entirely dead, an immediate and perhaps entire recovery of

all his faculties ensues. In some cases they have been completely restored on the head being replaced ; but in others they have remained long impaired, and in some have always continued so.

The reduction being accomplished, the patient should be immediately laid in bed. His head should be kept elevated, and retained by a proper bandage for a considerable time in one posture ; and with a view to prevent inflammation, blood-letting should be prescribed in such quantities as his strength will bear ; his bowels should be opened with proper laxatives ; and he should be confined to a low regimen,

S E C.

## SECTION VI.

*Of Luxations of the Spine, Os Sacrum, and  
Os Coccyx.*

**T**HE vertebræ, or bones of which the spine is composed, are so intimately connected, by the process of one bone running into corresponding parts of another, as well as by strong ligaments and muscles, that they are seldom dislocated. They are so firmly united indeed, that I do not suppose that any of them can be dislocated by external violence without being fractured. Besides the means of connection that I have mentioned, the vertebræ of the back are much strengthened by the support which they receive from the ribs.

I never met with a complete dislocation of any of the vertebræ ; nor do I suppose

that it ever happens, even when accompanied with a fracture, but with immediate death: For the force necessary to move one of the vertebræ from its situation, must not only be attended with the compression, but even with the laceration of the spinal marrow, while the contents of the thorax or abdomen must in a very essential manner be hurt by it. I do not suppose, therefore, that a complete dislocation of any of these bones can ever become an object of surgery.

We know, however, that one or more of the vertebræ may be partially dislocated, and that the patient may survive. In some cases, perhaps, a complete cure may be obtained; but I believe that it does not frequently happen.

These luxations are usually produced by falls from great heights; by violent blows; or by heavy weights passing over the body.

They are distinguished, by the body being distorted, by examination with the fingers, and by the symptoms which they induce; which are such as usually occur  
from

from compression of the spinal marrow ; particularly a paralysis of all that part of the body lying beneath the injured part, and either a total suppression of urine, or an involuntary passing of both urine and fæces. .

There is reason to suppose, from the mechanism of the parts, that the vertebræ will seldom or never be dislocated outwards : They are usually forced directly forward, or in some degree to the right or left. On this account they are extremely difficult to reduce, as the contents of the thorax or abdomen must always lie between the injured parts and the means that are used for this purpose.

Various means have been proposed, and different machines invented, for the reduction of dislocated vertebræ. These machines, however, should be laid aside, as being not only useless, but dangerous ; for whoever has paid attention to the anatomy of the spine, will see, that in dislocations of the vertebræ, scarcely any advan-

tage is to be gained from the application of much force, while much mischief may evidently ensue from it.

When one or more of the vertebræ are luxated forward, of which we can only judge by an accurate examination with the fingers, the most certain method, perhaps, of reducing the displaced bones is, to bend the body slowly and gradually forward, as far as it can be done, over a cask, or any other cylindrical substance of a sufficient size. If the bone by this position regains its situation, the body should be immediately raised; while the attempt may be repeated when it does not succeed at first.

When the displaced bone is pushed much out of its natural situation, neither this nor any other method will probably succeed; but it has certainly done so in different instances of partial dislocations. In bending the body forward, the two vertebræ lying contiguous to the one that is pushed forward are somewhat farther separated from each other; by which, the  
displaced

displaced bone may, either by the compression produced upon the abdomen, or by the ordinary action of the contiguous muscles, be forced into the situation that it formerly occupied.

When the dislocated bone, instead of being pushed straight forward, is forced in any degree to one side, the body while the reduction is attempting, should not only be bent forward, but somewhat towards the affected side; by which, the two contiguous vertebræ will be separated to a greater distance than they possibly could be by bending it either directly forward or towards the opposite side.

When any part of the os sacrum is luxated, all that can be done is to replace it with as much exactness as possible by external pressure, and by bending the body forward in the manner I have mentioned.

The coccyx is more frequently luxated than any of these bones, as it is equally



ly liable to the same kinds of injuries, besides being more exposed to the effects of falls, and to be injured in delivery.

This bone may be luxated either outwardly or inwardly. It is apt to be forced outwards in laborious births when much violence is used in pulling down the head of a child; and it has also been displaced by large collections of hard fæces in the rectum. We judge of this having happened, from the pain which takes place all over the region of the loins, particularly about the junction of the os coccyx with the sacrum; and from the displaced bone being discovered upon examination with the fingers.

When the coccyx is luxated inwardly either by falls or blows, the patient complains of much pain, and of the sensation of a tumor or some other hard body compressing the under part of the rectum; he is liable to tenesmus; he finds it difficult to pass his fæces; and in some instances, a suppression of urine takes place. On the finger being introduced at the anus, the

the displaced portion of bone is readily discovered.

In outward luxations of the coccyx, we seldom find it difficult to replace the bone by external pressure with the fingers; but it is often difficult to retain it in its situation. It can only be done by supporting the parts with proper compresses and bandages, for which purpose the T bandage answers better than any other.

In the reduction of an internal dislocation of this bone, the fore-finger of one hand, after being immersed in oil, should be passed as far as possible up the rectum. By means of it the bone should be pressed into its situation; while with the other hand we support the parts outwardly that correspond with it.

As dislocations of these bones, particularly of the coccyx, are very apt to excite inflammation, and as this often terminates in abscesses that do not readily heal, we should omit nothing that may probably tend to prevent it. Blood-let-  
ting

ting should be prescribed in proportion to the strength of the patient, particularly local blood-letting with leeches, or cupping and scarifying; a lax state of the bowels should be preserved; and the patient should be confined to that posture in which he is easiest, and to a low regimen.

S E C-

## SECTION VII.

*Of Luxations of the Clavicles.*

**T**HE clavicles are joined to the scapula at the acromion, where they give considerable support to the joint of the shoulder ; and their interior ends are supported by the upper part of the sternum.

As the clavicles are not possessed of much strength, and being tied at their articulations to the contiguous bones by ligaments, they are more exposed to fractures than to luxations. In some cases, however, they are luxated. This may happen at either extremity of these bones, but it is more frequent at their junction with the sternum than at the acromion ; for the force by which luxations of the clavicles are produced, is for the most part applied to the shoulders, by which their  
opposite

opposite ends are most apt to be pushed out.

As the clavicles are thinly covered, luxations of either of their extremities are easily discovered: They commonly produce a good deal of stiffness and immobility in the corresponding joint of the shoulder; for the neck of the scapula having lost its support, it is apt to be drawn out of its situation; by which the motion of every muscle connected with the joint is necessarily affected.

A dislocation of the clavicle is easily reduced by moderate pressure with the fingers, especially if the arms and shoulders are at the same time drawn back; by which the space which the clavicle should occupy may be somewhat lengthened. It is more difficult, however, to retain the bone in its situation, as it is apt to be again displaced on the pressure being removed, by the ordinary action of the flexor muscles of the arm.

We derive little advantage here from supporting the arm. On the contrary,  
when

when the end of the clavicle connected with the sternum is displaced, raising the arm does harm, as it tends to push the bone farther out of its place. It is, therefore, highly necessary to attend to this difference between the management of fractures and luxations of this bone. In the latter, an elevated posture of the arm does mischief: In the former, it proves useful, as I have shewn in Chapter XXXIX., Section V.

The weight of the fore-arm ought however to be moderately supported to prevent the shoulder from being too much drawn down. Besides this, the head and shoulders should be supported, and a moderate pressure made upon the displaced end of the bone. Various bandages have been proposed for this, particularly the long roller applied in such a manner as to form the figure of 8 upon the shoulders and upper part of the breast. No advantage, however, is gained from this, as the bandage cannot be retained so firmly in its situation as to have any effect

fect without impeding respiration. The machine represented in Plate XCIV. fig. 1. nearly the same as is commonly used for supporting the head, answers the purpose better than any other: For while it necessarily raises the head and keeps the shoulders back, the straps that pass over the upper part of the breast may be made to act with some force upon the dislocated end of the bone. It is scarcely necessary to observe, that the use of this machine should be continued for a considerable time, otherwise the bone is apt to start, when the whole is to do over again.

S E C-

## SECTION VIII.

*Of Luxations of the Ribs.*

**B**Y many it has been supposed that the ribs cannot be dislocated; and accordingly this variety of luxation has passed unnoticed by different writers on this branch of surgery. It is only at the articulation of the ribs with the vertebræ that luxations can happen; and being connected with these bones by strong ligaments, they more frequently break than yield at the joints.

It will readily, however, appear, by accurate examination of the junction of the ribs with the vertebræ, that they may be dislocated inwards. They cannot indeed be pushed either upwards, downwards, or backwards; but we know from experience, that a strong force applied near to their



articulations, will rupture their connecting ligaments, and thus push them forward; for the fact has been proved by dissection after death. I T O A

The symptoms induced by dislocations will be nearly the same, with those that ensue from fractures of the ribs, namely, pain in the injured part, with difficult respiration, and if the end of the bone is pushed into the substance of the lungs, emphysematous swellings may ensue from it. A dislocation, however, may be distinguished from a fracture, by the pain being most severe at the articulation; and by no part of the bone yielding to pressure excepting at this very spot. I believe it will commonly happen, that the end of a luxated rib, in consequence of its elasticity, will return to its natural situation, when the cause by which the luxation was produced is removed; but when it does not, the best method of reducing it will be, to bend the body forward over a cask or other cylindrical body, while the vertebræ immediately

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above and below the rib are pressed inward with as much force as can with safety be applied to them. After this, a thick compress of linen should be laid over these vertebræ, and another long one along the most prominent part of the dislocated rib and the two ribs immediately contiguous; when, by means of a long broad roller passed two or three times round the body, so much pressure may be made upon the vertebræ as will retain them in their situation; while the pressure made upon the projecting part of the rib tends to keep the end of it in its situation till the ligaments that were ruptured are again united.

No bandage should be applied with such tightness as to impede the breathing. The best method of preventing the roller from moving, is by the scapulary bandage passed over the shoulder, and a strap connected with it behind, carried behind the thighs and fixed to it before.

No dislocation is more apt to induce inflammation of the contiguous parts, and

other disagreeable symptoms; for the prevention and removal of which, nothing answers so well as copious blood-letting, preserving the patient cool, and at perfect rest, a low diet, gentle laxatives, and opiates if a cough ensues and becomes troublesome.

When the patient is in the first stage of the disease, and the joint is not yet much affected, the treatment should be directed to the removal of the inflammation, and the relief of the pain. This may be accomplished by the use of blisters, and the application of cold. If the inflammation is more extensive, and the pain more severe, the use of blood-letting may be necessary. The patient should be kept at rest, and the diet should be low.

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When the inflammation has subsided, and the joint is no longer painful, the patient may be allowed to move about, and the diet may be gradually increased. If the joint is still affected, the use of blisters may be repeated. The patient should be kept at rest, and the diet should be low.

When the inflammation has subsided, and the joint is no longer painful, the patient may be allowed to move about, and the diet may be gradually increased. If the joint is still affected, the use of blisters may be repeated. The patient should be kept at rest, and the diet should be low.

# SECTION IX.

## Of Dislocations of the Humerus at the Joint of the Shoulder.

**T**HE joint of the shoulder is formed by what is usually termed a Ball and Socket, the round head of the os humeri being lodged in a cavity on the anterior part of the scapula. This cavity, however, is so superficial, that in the skeleton it does not appear to contain above a tenth part of the head of the humerus; but in the recent subject it is much more considerable, by means of a cartilaginous brim; and a capsular ligament surrounds the whole joint. By this mechanism, the shoulder enjoys more free motion than other joints; but by this it is also exposed to more frequent luxations; inasmuch, that we meet with more dislocations of the

shoulder than of all the other joints of the body.

The os humeri is most frequently luxated downwards directly into the axilla, owing to the head of the bone meeting with less resistance in falling into this situation than in any other direction. The head of the bone is sometimes pushed downwards and forward, and lodged beneath the pectoral muscle, when we find it resting on the ribs between the coracoid process of the scapula and the middle of the corresponding clavicle. In a few cases it is dislocated downwards and backwards: But it can never be luxated upwards without being accompanied with a fracture of the acromion, or of the coracoid process, or perhaps of both. The head of the bone, as I have already observed, takes for the most part that direction in which it meets with the least resistance; but this also depends in some degree on other causes, particularly on the part of the joint which received the injury, and on the situation of the humerus

merus at the time. Thus, if a blow falls upon the upper part of the joint, while the arm is in a direct line with the body, and dislocation takes place, will be downwards; while the head of the bone will most probably be forced downward and inward by any stroke given to the outside of the joint while the elbow is stretched back, and vice versa.

We judge that the humerus is displaced by the patient being unable to move the arm; by pain being excited on every attempt to press the arm near to the side; by the arm being of a different length from the other; from its being longer or shorter according as the head of the bone is lower or higher than its natural situation in the acromion scapulae; by the head of the bone being felt either in the arm-pit, beneath the pectoral muscles, or backwards below the ridge of the scapula; and by a vacancy being discovered beneath the acromion. If the two shoulders are examined together, which should always be done, the sound joint will be

found round and prominent, while the fore-part of the other, if much tumefaction has not taken place, will appear to be flat, or even somewhat hollow. This difference in appearance between the two joints appears most obviously on viewing them both from above downwards.

In luxations of long duration, the whole arm is apt to become cedematous, and to be in some degree deprived of sensibility, from the pressure produced upon the nerves and lymphatic vessels of the arm by the head of the bone. All the other appearances I have mentioned, are likewise so obviously induced by the displacement of the head of the humerus, that scarcely any of them require to be explained. The head of the bone being thrown out of its natural situation, must necessarily affect the action of every muscle of the joint. Some will be too much relaxed, while others are over-stretched. The motion of the joint must of course be considerably impaired. It is obvious too, that much pain must be excited.

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cited by the arm being pressed down to the side, as the head of the bone will not only be forcibly rubbed against some part of the scapula, but the soft parts on which it rests must be greatly compressed, at the same time that some of the contiguous muscles will be stretched to a degree which they cannot easily bear.

In a simple dislocation of the humerus, our prognosis should in general be favourable; for, in recent cases we seldom fail in the reduction of the bone. Instances not unfrequently however occur, in which the operation is difficult; but this is seldom the case where it has been properly conducted from the first. In dislocations, indeed, of long continuance, the most expert practitioners often fail; for in such cases, the head of the bone has often formed a socket among the contiguous parts, from whence it cannot be dislodged without tearing asunder some of the muscles with which it is surrounded; and when dislodged, our endeavours may be rendered abortive, by the cavity in which  
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the bone should be lodged being diminished. In all cases; therefore, of long duration, that is, where the bone has been out of its place for six months or upwards; for I have often succeeded where it has been out two, three, and even four months; although it may be proper to make some attempts to replace the dislocated bone; yet none that require great force should be much persisted in; for the attempt must always be of uncertain success, & which necessarily gives a great deal of pain, at the same time that it is apt to render the motion of the head of the bone in the artificial socket, which it generally forms for itself, more stiff than it was before. In general it is supposed, that the humerus is more easily reduced when the head of the bone is lodged in the axilla than when it is pushed forward beneath the pectoral muscle; but more easily when lodged beneath this muscle than where it is forced back beneath the spine of the scapula. The latter I believe to be so; but I have not found in the treatment of the

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the others, that there is any difference between them.

In the reduction of a dislocated humerus, we are in general told, that it is to be done by extension, counter extension, and the subsequent application of such a force as is sufficient to replace the bone. These three indications, however, may all be comprehended in one. If a sufficient degree of extension is applied for drawing the head of the bone on a line with the acetabulum, the surgeon will seldom have any thing farther to do; for when brought to this situation, the reduction is almost in every instance instantly completed by the ordinary action of the muscles.

All that we have to do by counter extension, is to fix the body steadily while the arm is extending, and to prevent the scapula from being drawn forward by the force that is necessary for moving the arm; for if this bone be not fixed, it in some degree moves forward with the humerus, by which the force employed for  
extending

extending the arm is in some measure lost, at the same time that the cavity in the scapula in which the head of the bone is to be placed, is thus kept in a state of motion, by which the reduction cannot be so readily effected.

This being done, our powers of extension are applied, to the arm, till the head of the bone is drawn on a line with the brim of the socket; when, as I have observed above, it will instantaneously slip into its place by the action of the contiguous muscles; so that there is no necessity for the application of any force for this purpose. Much mischief has often been done by force applied with this view, as we shall presently see on considering the different modes of reducing dislocations of this joint; for it is obvious, if the force that is used for raising the humerus is applied before the end of it is drawn past the most projecting point of the scapula, that the two bones must be thus pressed together so as to obstruct the reduction.

Various

Various modes have been proposed for the reduction of dislocated shoulders, in-  
somuch that we seldom meet with two  
practitioners who do it in the same man-  
ner: But as one or other of these must be  
preferable to the rest, and as it is of much  
importance to have this ascertained, I shall  
offer a few observations upon each of them;  
and shall more particularly describe that  
which to me appears to be the best.

1. The humerus is often reduced by  
pressure with the heel upon the head of  
the displaced bone. The patient being  
placed upon the floor, the surgeon also sit-  
ting upon the floor directly before him,  
puts the heel of one foot, that of the left  
foot when he is operating upon the left  
shoulder, and vice versa, upon the head of  
the bone; and laying hold of the fore-arm  
with both hands, he extends the arm, at  
the same time that he endeavours with his  
heel to push up the bone.

When the head of the bone has fallen  
directly downward into the arm-pit, we  
are

are directed by some to place a small tennis ball or any other round substance between it and the heel; by which the pressure may be continued with more certainty into the bottom of the axilla than where the heel alone is employed.

This method, however, is liable to three very important objections. 1. By laying hold of the fore-arm, the joint of the elbow is considerably stretched, by which it may be much hurt, while a great part of the force is spent upon it which ought to have been applied entirely to the os humeri. 2. By extending the fore-arm, several of the muscles of the arm itself, as well as the biceps flexor cubiti are put upon the stretch; by which the extension is rendered much more difficult than when these muscles are relaxed by the joint of the elbow being properly bent. And, lastly, whether the heel be employed by itself, or with a ball, it is much more apt to do harm than good; for if it be not applied with such nicety and exactness, as to push the head of the bone directly towards the socket,

socket, it must necessarily force it against the neck of the scapula, or some of the contiguous parts, and will thus tend in the most effectual manner to counteract the extension of the arm.

Besides, in this manner, the arm must in every instance be pulled in a very oblique direction downwards by the relative situation of the surgeon and patient; whereas it should in some cases be raised nearly, though not entirely, to a right angle with the body, and kept in that position while the extension is going on.

It may be alleged, indeed, that this method often succeeds, and that it has long been employed by some of our oldest and most experienced surgeons. This I admit: But I also know that it often fails, even with those who speak most favourably of it; and that other modes of treatment have in various instances answered, where this had previously failed.

2. Others attempt to reduce this dislocation, by endeavouring to force the head of the bone into the socket with a rolling-pin

pin applied beneath it, while a sufficient force is employed for extending the arm, and for fixing the body in its situation. With a view to prevent the pin from hurting the skin, we are desired to cover it with flannel, and that part of it which passes into the axilla is directed to be more thickly covered than the rest.

But however this may in some instances succeed, it ought by no means to be received into practice. It is evidently liable to most of the objections I have mentioned to the mode of operating with the heel; particularly to the risk of forcing the head of the humerus in beneath the neck of the scapula, and thus counteracting the force employed for extending the arm. It is obvious, too, even on the principle upon which it is recommended by those who practise it, that this, as well as the mode of operating with the heel, cannot be applicable where the head of the bone is lodged either backward, or forward beneath the pectoral muscle: For the sole intention of both is to raise the head of the bone; and yet

yet by some they are used indiscriminately, whether the bone is luxated downwards, backwards, or forward.

3. The patient being properly placed, the body fixed by assistants, and the arm extended in the manner I shall afterwards direct, some surgeons make use of a towel or girth for pulling the head of the bone into the socket. The ends of the girth being tied together, one end of the double is put over the arm, and carried near to the head of the humerus; and the other being passed over the neck of the operator, he forces up the end of the bone by raising his neck; and if this could be done with sufficient exactness, just when the head of the humerus has cleared the brim of the socket, no harm would arise from this part of the operation; but if the force for elevating the bone be applied before a sufficient degree of extension is made for this purpose, it must evidently do mischief, by locking the head of the humerus and neck of the scapula together: So that this is in some



measure liable to the same objections that I have stated to the mode of operating with the heel and rolling-pin.

These were the means usually employed for reducing luxations of this joint; but being frequently found to fail, others have at different times been proposed in order to increase the powers of extension.

4. Of this nature is the *Ambe* of Hippocrates, as it is usually termed: It is the one that was chiefly employed by ancient practitioners, and in some parts of Europe it is still the only instrument used for this purpose: For this reason I have given a delineation of it in Plate LXXXVIII. fig. 1., but I do not by any means advise it to be employed. The powers of which it is possessed are great, but they cannot be properly applied; so that they are pernicious in proportion to their extent. It is liable in a tenfold degree to the objection I have stated above to the three preceding modes of reducing this bone, that of pressing the head of it against the neck of the scapula; by which one or  
other

other of them must frequently be broken, as will readily occur to whoever examines this instrument with attention; for instead of extending the arm before raising the end of it, the first action of this instrument is to raise the extremity of the bone, by which it must be so firmly pushed in beneath the neck of the scapula, as to counteract with much effect the power afterwards applied to extend it.

5. The method of reducing this joint by means of a ladder has been long known, but I hope not often employed. The dislocated arm being hung over the upper step of the ladder, to which height the patient must be previously raised, and being secured in this situation by assistants, the seat on which he is placed is suddenly drawn away; by which the whole weight of the body falls upon the luxated joint and by which we are told the bone may often be reduced when other means have failed. The top of a high door is sometimes used for the same purpose. Whether the door or ladder is

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employed, that part upon which the arm is made to rest should be well covered with several plies of soft cloth or flannel.

6. The patient being laid upon the floor, the bone has in some instances been reduced by two or three stout men standing upon a table, and lifting him suddenly up by the luxated arm.

7. Upon the same principle, it has been proposed to raise the patient by the luxated arm with ropes running over pulleys fixed in the ceiling of a high-roofed apartment. The jerk produced by the body being suddenly raised and let down, has in some cases succeeded where other attempts to reduce the humerus had failed.

This was first practised, I believe, by the ingenious Mr White of Manchester; and I have known it succeed in different cases of old luxations: But these methods are all liable to great objections. The force is too suddenly applied; by which more mischief may be done to the surrounding soft parts than can be compensated by the reduction of the bone. We  
know

know that muscles, bloodvessels, and ligaments, will stretch to a considerable degree, if the extending force be applied in a gradual manner: But we also know, that they very readily break when powerfully and suddenly stretched. Of this we have a remarkable instance in the bursting of the capsular ligaments of joints, which I believe to happen, as I have endeavoured to shew, in almost every case of luxation from external violence. This leads us to say, that any force that is used for the reduction of luxations should be applied in the most gradual manner, and that the mode of operating we are now considering, must frequently do harm by tearing and lacerating the soft parts surrounding the joint. Of this I have had various instances even where the teguments have been protected in the most cautious manner, by covering them with soft flannel, and afterwards with firm leather, before applying the ropes for extending the arm.

Besides, in these modes of reduction, the arm must be always extended in the same direction,

direction, whether the bone be luxated forward, downward, or backward: Whereas the direction in which the arm is extended, should vary according to these circumstances; as must be obvious to whoever attends to the anatomy of the parts concerned in the luxation. Nay in one variety of luxation, irreparable mischief may be done to the joint, by extending the arm in a direction which, in another, might not only be proper, but necessary. Where the head of the humerus is pushed forward beneath the pectoral muscle, or directly backward, we may readily suppose that it may be easily reduced by pulling the arm upward, as is done when the body is suspended by a pulley in the manner I have mentioned; while much harm may be done by it, where the head of the bone is lodged in the axilla, and pushed beneath the neck of the scapula. In this case, the end of the humerus is often so firmly wedged between the scapula and ribs, that one or other of these bones would necessarily break by the sudden application of  
much

much force in this direction; and it can only be prevented by extending the arm somewhat obliquely downward till the head of the humerus is quite disengaged.

8. A machine has been invented for conjoining the power of the ambe, with the mode of operating we have just been considering; in which the patient's body is nearly suspended by the dislocated arm, and is suddenly raised and let down again while the operator endeavours with the lever of the ambe to elevate the head of the bone. The invention is ingenious, and the instrument is evidently powerful; but if our objections to these two modes of operating, taken separately, are well founded, they are no less so when they are combined. The powerful action of the lever must be hazardous in proportion to the uncertainty of its application. While the body is quickly rising and falling, the lever cannot possibly be applied with exactness to the end of the bone; and if made to act with much force before the head of

the humerus is cleared of the scapula, one or other of these must necessarily give way.

9. When the more simple methods of reducing luxations have failed, ropes and pulleys have sometimes been employed. Of these, different forms may be seen in Plate LXXXIX. fig. 2.; in Scultetus, Plate XXII. fig. 1.; and in Plate X. fig. 7. of Desagulier's Experimental Philosophy. With one or other of these, any degree of force may be applied that can ever be required for this purpose.

10. But when recent cases are properly managed, luxations may in almost every instance be reduced without any assistance from machinery. I often succeed by the moderate extension I am able to make of the arm with one hand, while the other is employed in pressing back the scapula. This, however, requires all the muscles of the arm and fore-arm to be as much relaxed as possible; which we accomplish by bending the elbow moderately, raising the arm to a height somewhat less than a right angle with the body,

dy, and preserving it in such a direction as to prevent either the pectoral or extensor muscles of the arm from being stretched. When the arm is in this situation, we often find luxations easily reduced which had previously resisted the greatest force; for in this manner we not only relax the muscles of the arm, but the capsular ligament of the joint; by which the head of the bone returns more readily by the opening at which it was forced out than it otherwise possibly could do. For when the ligament is much stretched, it will grasp the neck of the bone, by which our being able to return it will necessarily be rendered more uncertain.

More force, however, is sometimes required than can be applied in this manner; and the following is a method by which I have never yet failed in recent luxations. The patient is seated upon a chair, and his body secured by a long broad belt passed round it, and given to assistants, or tied round a post; A firm band  
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of leather, four or five inches broad, and lined with flannel, as is represented in Plate LXXXIX., fig. 3., is now tied round the arm immediately above the elbow. The three straps or cords connected with this band being given to assistants, they are desired to extend the arm in the relaxed position I have mentioned, and in a slow equal manner, while another assistant standing behind is employed in keeping the scapula firm. The surgeon himself stands most conveniently on the outside of the arm: His business is to direct the assistants in the degree of force they are to employ, and to point out the direction in which the arm is to be extended; he may also support the fore-arm and retain it bent at the elbow, in the manner I have mentioned. As soon as the head of the bone is drawn clearly past the brim of the socket, the extension of the arm should be somewhat relaxed, when the reduction will for the most part be accomplished by the action of the muscles of the joint; or it will be readi-

ly effected by moving the arm gently in different directions. A crack is heard on the bone slipping in; the patient finds immediate relief; and the anterior part of the shoulder acquires its usual prominent form.

The direction in which the arm is extended, must depend upon the situation of the head of the bone. That in which it will meet with the least resistance is always to be preferred. When the head of the bone is pushed forward, and lodged beneath the pectoral muscle, the arm should be raised to a right angle with the body, and the same direction will answer where it is pushed backward; but in the most frequent kind of luxation of this joint, where the head of the bone is lodged in the arm-pit, the arm should uniformly be drawn somewhat obliquely downward. If extended when raised to a right angle with the body, it would be drawn against the neck of the scapula, by which much pain would be excited, and the reduction frustrated. Of this I have

have seen many instances, as every practitioner must have done.

It should be a general rule in the treatment of every luxation, to vary the direction in which the extension is made as soon as any considerable resistance is met with; but in luxations of the humerus, attention to the observations I have just thrown out will for the most part prove sufficient.

In reducing luxations of this joint, it has been the prevailing practice to press the scapula forward and downward: Nearly the reverse of this, however, should be adopted. By pressing the scapula downward, we force it against the head of the humerus, the very thing we ought most carefully to avoid: And by forcing it forward, it is evident that the end of the humerus will not be so easily drawn out from beneath it, as when the assistant is desired to pull it backward in the manner I have mentioned.

11. The mode of treatment I have just been describing, will succeed in almost every instance of recent luxation; and it  
will

will seldom fail even in cases of long standing, where the reduction of the dislocated bone is practicable: But when a greater force is required than can be applied in this manner, the instrument represented in Plate XC. may be employed. It was invented by the late Mr Freke of London; and it answers the purpose of extension better, and with more exactness, than any that I have seen. It is delineated exactly from the plate given of it by Mr Freke; but it admits of some improvements. The strap A A which passes over the shoulder, presses down the scapula, and thus impedes the reduction of the bone: It should therefore be either entirely wanting, or made with a slit to pass over the arm so as to draw the scapula back: In which case, instead of passing obliquely downwards to be fixed in the floor, it should pass straight across, and be fixed in a post on a line with the shoulder.

I have already observed, that the use of a lever in raising a luxated humerus  
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is both unnecessary and dangerous : The lever of this instrument, therefore, instead of being moveable, should be fixed so as only to serve as a support to the arm ; or if it ever is used as a lever, it should be managed with the utmost caution. The principal advantage that we derive from this instrument, is our being able, by means of it, to apply any force that may be necessary in the most gradual manner ; an object of the first importance in the reduction of luxations : It also extends the arm in any direction we may judge proper ; by which it can at once be adapted to any variety of luxation.

Swelling, pain, and inflammation, when they occur as consequences of luxations of the arm, are to be removed by the remedies usually employed in such cases, but chiefly by local blood-letting with leeches.

The round head of the biceps flexor cubiti, which passes through the joint of the shoulder, and is lodged in a groove in the head of the humerus, is apt to be separated from this bone when it is forced

ced far out of its natural situation, and thus induces a stiff unwieldy state of the arm: For the most part it returns immediately to this groove on the dislocation being reduced; so that there is commonly cause to suspect that it continues to be displaced when any unusual pain, stiffness, or tension remain. The most certain method of replacing it is to move the arm from time to time in every variety of way; and we know that it is replaced, by an instantaneous removal of the distress.

The glenoid cavity of the scapula being very superficial, the head of the humerus is apt to fall out again, even after it has been completely replaced; particularly when it has been frequently luxated. The most certain method of preventing this is to support the arm in a sling, as is represented in Plate XCIX. fig. 2., till the parts recover their tone. Blisters applied to the shoulder, and pumping cold water over the joint, have also proved useful for this purpose.

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## SECTION X.

*Of Luxations of the Fore-arm at the Joint of the Elbow.*

**T**HE bones of the fore-arm at the elbow are more frequently dislocated upward and backward than in any other direction: They can scarcely be luxated laterally or forward, if the injury be not at the same time accompanied with a fracture of the olecranon or top of the ulna, as will be readily perceived on examining the connection of that process with the cavity in the posterior part of the os humeri.

As the joint of the elbow is not deeply covered with soft parts, luxations of the bones are easily discovered as long

as

as swelling and tension have not taken place. When these symptoms occur to any extent, it is often difficult to distinguish either the nature or extent of the injury with which they are connected. When the luxation is backward, the olecranon is felt on the back part of the arm, and the condyles of the humerus are pushed forward. When the olecranon is broken off, and the ulna and radius pushed forward, they are also apt to be drawn upward on the anterior part of the humerus, when the condyles of that bone are discovered behind. The extent of the joint is so considerable from one side to the other, that the bones composing it can never be completely luxated laterally, unless the soft parts with which they are covered are much lacerated. In whatever way they are displaced, the joint becomes immediately stiff and immoveable.

In the reduction of these dislocations, the patient should be seated on a chair of a convenient height, and the arm firmly



secured by an assistant: When the bones are luxated backward, the fore-arm should be moderately bent, in order to relax the flexor muscles: While in this position it should be slowly and gradually extended; and if care be taken to increase the curvature of the elbow in proportion as the extension is made, we seldom or never fail to complete the reduction. Where the olecranon is broken off, and the ends of the radius and ulna pushed forward and drawn up upon the humerus, we are under the necessity of extending the arm while in a straight position, as in this case the heads of these bones are pushed back upon the anterior part of the humerus on the least attempt to bend them. The extension should be continued till the ends of both bones are pulled somewhat lower than the most depending point of the humerus, when they will either regain their situation by the action of the muscles, or be easily forced into it.

In lateral dislocations of these bones, the extension must also be continued till they

they have clearly passed the end of the humerus, when by moderate lateral pressure they will for the most part be easily replaced. Of whatever kind the dislocation may be, the extension should be made by assistants grasping the arm immediately above the wrist; and while they are thus employed, much advantage may be gained by the surgeon pressing down the heads of the bones.

In two cases of dislocation of these bones, where their heads were drawn up upon the back of the humerus, the reduction was not accomplished, although a great force was applied, not only in pulling at the under part of the arm, but in pushing down the heads of the displaced bones. In one of them, where the olecranon was pushed through the teguments, that part of the bone was sawn off, by which the reduction was effected: In the other, this expedient was not advised; and the practitioner finding all his efforts to reduce the bones prove abortive, the limb was amputated. As the exten-

sion in both was applied while the arm was stretched out, and as I have never failed in similar cases where the arm was bent, I conclude, that in the one the arm would have been saved, and in the other the joint preserved entire, if this practice had been adopted.

The reduction being completed, the fore-arm should be kept in a relaxed position, by keeping the elbow moderately bent.

These bones, when reduced, do not readily fall again out of their place ; but it is proper in this, as in every case of luxation, to preserve the limb as much at rest as possible till the injured parts have recovered their tone.

The bones of the fore-arm are also liable to be dislocated in their connection with each other. At the joint of the elbow a projecting part of the radius is lodged, and moves in a corresponding cavity of the ulna ; and below, a portion of the ulna is received by a similar cavity in the radius. Instances have occurred

curring of these bones being separated from each other at both these points of connection; but any separation of this kind is more apt to happen at the wrist than at the elbow. It is known to have occurred, by all the usual signs of luxations: By pain, swelling, and distortion in the injured part; by the motion of the joint being impaired; and by manual examination.

In general, the displaced bone is easily put into its situation; but for the most part we find it difficult to retain it. The most certain method of effecting this, is, to put a long firm splint along the outside of the arm from the elbow down to the points of the fingers, and another of the same length on the inside; the whole to be secured with a flannel roller, and the arm hung in the sling represented in Plate XCIX. fig. 2. By this we prevent the rotatory motion of the radius, and the pronation and supination of the hand; and if this is guarded against for a sufficient length of time, a cure may

at last be expected, while want of attention to this is frequently the cause of the joint at the wrist remaining stiff for life ; of which I have met with various instances.

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## SECTION XI.

*Of Luxations of the Bones of the Wrist.*

THE bones of the wrist are not so frequently luxated as might be expected from the smallness of their size, owing to their being firmly connected by ligaments; as well as to the strength which they derive from the whole tending to form a kind of arch; the convex part of which being on the outer or back part of the hand, where it is most exposed to injuries, is particularly well calculated for preventing any of the bones from being displaced.

Degrees of force, however, are sometimes applied to them which they are unable to resist. From their form, it will appear, that they will most readily be dislocated outward. The three superior carpal  
K 4 bones,

bones, which form a kind of projecting head, that is lodged in a superficial cavity in the under extremities of the ulna and radius, may either be dislocated at this joint, or they may be separated from the five inferior bones of the wrist. In some instances, one or more of these bones are separated from each other; and in others they are dislocated at their connection with the bones of the metacarpus and the superior bone of the thumb.

As these bones are not thickly covered with soft parts, the nature of the injury becomes immediately obvious: But in some cases, where perhaps a single bone is only partially displaced, if the parts be not examined with attention, the symptoms that occur are apt to be attributed to a sprain; and the real cause of them being overlooked, a permanent lameness is thus induced, which with much ease might have been prevented. Of this I have met with various instances. Similar occurrences, however, may always be prevented by an  
early

early and attentive examination of the injured parts.

In reducing luxations of these bones, we are in general desired to stretch the arm and hand upon a table, and while they are in this position, to push them into their situations : But it is better to have the arm and hand supported by two assistants, as in this situation the surgeon gets ready access to both sides of the wrist. The assistants should be desired to keep the parts sufficiently firm, but not to stretch them ; and when in this situation, the surgeon will seldom find it difficult to push the bones into their places. They must be retained by splints and bandages in the manner mentioned in the last section ; and as dislocations of these bones are very apt to induce inflammation of the ligaments and other contiguous soft parts, repeated applications of leeches should be advised as the most certain preventive.



## SECTION XII.

*Of Luxations of the Bones of the Metacarpus,  
and Fingers.*

**W**E have seen in the last section that the metacarpal bones may be dislocated at their junction with the bones of the wrist; and they are sometimes displaced at their under extremities, where they are connected with the bones of the fingers. They are not so frequently luxated, however, as at first view might be expected; probably from the joint of the wrist being so moveable, that the whole hand readily yields to any force that is applied to it.

The bones of the fingers and thumb are also sometimes luxated; but we likewise consider the mobility of these bones as the principal reason of their being less frequently

frequently dislocated than many of the largest and strongest bones that are more firmly connected together.

Dislocations of these bones are easily discovered by all the usual symptoms of luxations; but particularly by the deformity which they produce, which in this situation is always conspicuous.

When any of the metacarpal bones are displaced at their connection with the bones of the wrist, the best method of reducing them is, by keeping the arm steadily fixed, and pushing them from above downward, while the hand remains loose and moveable. When the first phalanx of any of the fingers is moved from its junction with the corresponding metacarpal bone, it is to be replaced by one assistant fixing the hand, while another draws down the dislocated finger, which should be done by grasping the first phalanx only, in order to prevent the other joints of the finger from being hurt. Dislocations of all the other joints of the fingers,

fingers, as well as of the thumbs, are to be managed in the same manner.

In the reduction of these dislocations, the bone should not be pulled down till it is somewhat raised or elevated from the contiguous bone; for as all the bones of the fingers and thumbs, as well as those of the metacarpus, are thicker at their extremities than in any other part, these projections are apt to be forced against each other when the extension is made in a straight direction. In this manner the greatest force has frequently been employed in vain; nay, fingers have been amputated where this alone prevented luxations from being reduced, and in which a very inconsiderable force would have proved successful, if the displaced bone had been somewhat separated from the other before any force was applied for extending it.

SECTION XIII.

*Of Luxations of the Femur at the Hip-Joint.*

**T**HE socket or acetabulum, formed by the ossa innominata, for lodging the head of the thigh-bone, is so deep; the brim of the socket in a recent subject contracts so much about the neck of this bone; the head of the bone is so firmly tied down to the bottom of the socket by a strong ligament; and it is so confined by strong muscles, that we would not *a priori* suppose that it could be luxated by external violence: We would rather imagine that it would break at the neck where it is weakest, than that the head of it should ever be forced from its socket: This opinion has accordingly been adopted by many in all ages. For a considerable

able time I was disposed to favour it, from having observed several cases which at first were supposed to be luxations, but which proved to be fractures of the neck of the femur. In the course of the last few years, however, I have seen several cases in which I was convinced that the thigh bone was luxated. The nature of the symptoms gave reason to imagine that they arose from luxations; and they were proved to do so by the patient's being instantaneously and completely relieved, and rendered quite able to walk, on the head of the bone being replaced; which in a fracture of the bone could not happen.

In treating of fractures of the thigh-bone, the circumstances by which fractures of the neck of it may most readily be distinguished from luxations, were mentioned: I shall therefore refer for this part of our subject to the eleventh Section of the preceding Chapter.

It is said by authors, that the head of the femur may be luxated in various directions, namely, upward and backward,

upward and forward, downward and backward, downward and forward, and I may add directly downward. That all of these may happen, I cannot take it upon me to deny ; but I believe few practitioners have met with an instance of the first and third. The second variety, where the head of the bone passes up upon the os pubis, may happen ; as may likewise the last, where it is forced directly down ; but I have never seen any variety of this luxation if it be not that in which the head of the femur is pushed downward and forward, and lodged in the foramen ovale. All practitioners admit, that the bone is most frequently dislocated in this direction ; and an examination of the skeleton, as well as of the recent subject, will show why it should be so. The brim of the socket over all the upper and back part of it, is not only stronger, but more elevated than the rest of it. It falls away as it descends ; and on the anterior under part of it there is a considerable vacancy in the bone, the space being filled with a ligament

gament only ; and as this opening is sufficiently large to admit the head of the femur, we easily see how luxations should be most apt to occur here.

Every luxation of the femur must be productive of lameness, and of pain, tension, and other symptoms with which other luxations are accompanied. When the head of the bone passes upward and backward, the leg must be much shorter than the other ; insomuch that the points of the toes only will touch the ground when the patient is standing upon the other foot ; the great trochanter of the thigh-bone will be higher than in the other side ; the knee and foot turned inward ; and a good deal of pain must be induced by every attempt to turn them out.

When the femur is luxated upward and forward, the leg must be shortened ; the head of the bone will be felt resting above the os pubis in the groin ; the great trochanter will be on the upper and anterior part of the thigh near the groin, while a vacancy is discovered in that  
part

**part** of the hip which it ought to occupy; the knee and toes will be turned outwards; and if the dislocation be not soon reduced, pain, tension, and inflammation, will occur in the spermatic cord and testis, from the pressure made upon the cord by the head of the bone.

If ever this bone is luxated downward and backward, the leg will be considerably longer than the other; the knee and toes will be turned inward; and the great trochanter will be much lower than the same protuberance of the other limb. When the head of the bones passes directly downward, the leg will also be longer than the other, and the trochanter will likewise be lower; but the knee and toes will retain nearly their natural situation; only every attempt to move them will be productive of pain.

In the most frequent luxation of the femur, the leg appears to be considerably longer than the other; the knee and points of the toes are turned outward, nor can they be moved either farther



outward or inward but with much pain: all the muscles in the internal part of the thigh are tense and painful; the femur cannot be felt on the outside farther up than the middle of the thigh; a vacancy is discovered in the usual seat of the great trochanter, which is found farther down and on the anterior part of the thigh, while the head of the femur is plainly felt a little below the groin; being seated, as I have observed above, in the foramen ovale.

In luxations of the femur, the difficulty and uncertainty of reducing them has been considered as so great, that in general we have been advised to give a very doubtful prognosis of the event. In cases of long duration, this should always be done: For besides other causes which add to the difficulty of reduction, the muscles here are so strong that they resist, in the most powerful manner, every attempt to dislodge the head of the bone after it has been long fixed among them: by contracting round the neck of the  
bone,

bone, they must even be torn asunder before it can be reduced: But in recent luxations we have not this difficulty to encounter; and we know that with proper management the bone may in almost every instance be reduced.

The reduction of this bone is commonly attempted by pulling the limb downward; and it seems to be an opinion very universally received, that any force we employ should be applied in this direction. Some advise the limb to be drawn directly down from the part in which the head of the bone is lodged; others desire it to be pulled exactly in a line with the hip-joint, while others turn the knee somewhat inward. The patient being placed upon his back, and properly secured, the limb is extended in one or other of these directions, either till the reduction is accomplished, or till such a force is applied as makes the operator afraid of doing harm were he to proceed farther.

It must be allowed, that dislocations of the femur have in various instances been

reduced in this manner: It might often succeed where the head of the bone is forced upwards; but I may without hesitation assert, that even in this case the reduction might be effected with less force in a different manner; and in a great proportion of cases, where the head of the bone is lodged in the foramen ovale, or where it is forced directly downwards, that we must necessarily fail entirely by confining the line of extension to any of the directions I have mentioned.

In whatever way the head of the femur is luxated, it must pass over some inequalities or prominent parts of the contiguous bones: These it must again pass over before it is reduced; at least this must be the case if we wish it to return by the same route, and it will be admitted in the treatment of luxations to be a good general rule, to endeavour to replace the bone by the opening at which it passed out. But where the limb is only pulled downward in the usual way, the head of the bone will be forced against

gainst the projecting brim of the socket; if the dislocation is upward; or it will be drawn to a still greater distance from the joint where the bone is dislocated either directly downward, or lodged in the foramen ovale in the upper and inner part of the thigh. Wherever the head of the bone may be lodged, it should be completely raised above any projecting part of the contiguous bones before any other attempt is made for reducing it. As this will remove the principal impediment to the reduction, if the muscles of the limb are at the same time relaxed, it will easily be drawn into the socket when the dislocation is upward, or pushed into it where the head of the bone is already beneath it.

In the most frequent variety of this luxation, where the head of the bone is pushed downward and forward, I have succeeded in the following manner: The patient is laid upon his back across a bed, and firmly secured by two or three assistants: A broad strap, or table-cloth, pro-

perly folded, is passed between his thighs, and over the groin on the sound side, and given to two other assistants: A similar strap is passed round the luxated thigh as near as possible to the head of it; the ends of which must be given to an assistant standing on the opposite side: The belt represented in Plate LXXXIX. fig. 3. being previously fixed upon the under part of the thigh, the straps connected with it are given to an assistant or two, while the knee is supported by another assistant with the leg moderately bent. The thigh is now to be moderately stretched by the assistants who have the charge of the straps at the under part of it; but the extension should not be carried farther than what may be considered as necessary for drawing the head of the bone down to the under part of the foramen ovale; and this may be always done with a moderate force. The strap round the top of the thigh must now be firmly pulled by those who have the charge of it; who, standing somewhat higher than the patient,

patient, should draw the thigh upward and inward ; and the extension should be continued in this direction till there is reason to suppose that the head of the bone is clearly raised from the foramen in which it was lodged. At this time the person who has the charge of the knee should be desired to move it somewhat inward, and to push the head of the bone upward and obliquely outward : He will do this with the greatest certainty of success, if he secures the knee with one hand, and the foot with the other, at the same time that he takes care to keep the leg just so much bent as may relax all the flexor muscles without stretching the extensors. If the different assistants perform their parts properly, the first attempt will answer ; but if any of them have failed, particularly if the head of the bone has not been sufficiently raised from the hollow in the foramen ovale before being pushed upwards, the attempt must be repeated.

As the head of the bone may for the most part be felt outwardly, the surgeon may in general ascertain with certainty whether it is sufficiently raised or not. If he finds it rise easily, the force may be continued till it appears to be about an inch higher than when it was first applied; while, on the contrary, if it yields with difficulty, there will be reason to suspect that some part of the head of the bone is fixed or locked in the upper part of the foramen ovale; in which case the force in this direction should be discontinued, and the other assistants at the knee being directed to increase the extension downward, it will afterwards be more easily raised.

In whatever direction the bone may be dislocated, the point requiring most of our attention, is the raising the head of the bone sufficiently before any attempt is made to force it into the socket. This being accomplished, a very slight force will in general draw it down when the dislocation is upward; and when dislocated

ected downward; whether it is somewhat backward or directly on a line with the socket, it will be easily pushed up.

In this manner recent luxations of this joint may for the most part be reduced; and the same treatment is perhaps the best even in luxations of long duration. In these it will sometimes fail; but it will succeed, I believe, as frequently as any other that has yet been proposed, while it is not productive of the dreadful pain that commonly ensues from the use of those machines that have been invented for a greater extension of the limb. When any additional force, however, is judged necessary, it may either be obtained by a proper application of Mr Freke's machine, represented in Plate XC., of Mr Petit's in Plate LXXXVIII. fig. 2., or of the pulleys and ropes represented in Plate LXXXIX. fig. 2.

It should be remarked, however, that this kind of assistance can never be applicable where the luxation is downward. Extension of the limb having been considered



sidered as necessary in every variety of luxation, it has often been indiscriminately employed, whether the head of the bone was placed above or below the socket : It is obvious, however, that it is in the former only that it can ever prove useful ; and in the latter, that much mischief may ensue from it.

The violent distension of the muscles, and extensive laceration of the articular ligaments, with which luxations of this bone must always be accompanied, render much care and attention necessary long after the reduction is accomplished. Local blood-letting with leeches, or cupping and scarifying, proves particularly useful here, and should be repeated more or less frequently according to the violence of the symptoms, and age and habit of the patient ; and till the parts may be supposed to have recovered their tone, the patient should be kept as much at rest as possible.

By many it is imagined that the femur may be partially luxated ; and the appearances

ances which are supposed to arise from what is termed a Subluxation of this bone are described by authors : Of these, however, I have taken no notice, as it is not my opinion that this bone can ever be partially luxated. The head of it is so round, and the brim of the socket so narrow, that whoever examines them will be convinced that it cannot happen. The head of the bone may, in a gradual manner, be pushed out of the acetabulum by a tumor at the bottom, but I do not suppose that it can ever occur from external violence.

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## SECTION XIV.

*Of Luxations of the Patella.*

**T**HE Patella may be either partially or completely luxated, and it may be displaced either upward or downward, outward or inward: It may also be luxated by itself, or it may be displaced along with the tibia and fibula in luxations of these bones. It cannot, however, be completely luxated in any direction, if it be not accompanied with a rupture of the ligament by which it is tied to the tibia, or of the tendon of the rectus muscle connected to the upper part of it; and it will be more readily dislocated inwardly than in any other direction, owing to the internal condyle of the femur being somewhat less prominent than the other: For as this  
bone

bone is placed in some degree between these condyles, it will necessarily be most easily forced out at that side where it meets with the least resistance.

Luxations of this bone are, for the most part, easily discovered, as it is thinly covered with soft parts: But when it has been long displaced, it is apt to induce so much tumefaction, not only about the joint, but over all the contiguous parts, as to be distinguished with difficulty. Even the most partial luxation of the patella always gives considerable lameness and much pain on every attempt to move the joint.

In the reduction of a luxated patella, the patient should be placed either on a bed or on a table, and his leg should be stretched out and kept in this posture by an assistant. The surgeon should now lay hold of the bone, and endeavour to push it into its situation; but instead of pushing it directly forward, it should first be somewhat raised, otherwise we are apt to force it against the condyles of the femur

mur or head of the 'tibia. The best method of effecting this is to press down the side of the bone most distant from the joint; by which the opposite side of it will be elevated, when a very moderate force will press it into its place. When the patella is drawn out of its situation by the tibia and fibula being displaced along with it, it cannot be replaced till the reduction of these bones is accomplished.

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## SECTION XV.

*Of Luxations of the Tibia and Fibula at the Joint of the Knee.*

THE tibia is the only bone of the leg that is immediately concerned in the joint of the knee; but as this bone cannot be dislocated without drawing the fibula along with it, I think it right to mention them together.

As more strength is required in the knee than in any other joint of the body, the bones of which it is chiefly formed, the femur and tibia are connected together by the strongest kind of articulation, namely by *Ginglimus* or the Hinge-like joint: The surfaces of the two bones are very extensive, and they are firmly tied together

together by strong ligaments : There is also reason to suppose, that the moveable cartilages placed between the ends of these bones have some influence in lessening the friction of the joint, and in thus rendering it more firm than it otherwise would be.

The great strength of this joint is the reason of its being less frequently dislocated than any other in the body : It cannot indeed be completely dislocated but by the application of so much force as will not only rupture the teguments which cover it, but the strong ligaments and tendons which tie the bones together. As this requires a very unusual degree of violence, these bones are seldom forced entirely past each other ; and the same reason even prevents them from being often partially luxated. When either a complete or partial luxation, however, is produced, it may happen nearly with equal ease on either side ; but the bones will be more readily forced backward than forward, owing to the flex-

or muscles and tendons of the leg being much stronger than the extensors.

The most partial luxation of this joint is readily distinguished, not only by the violent pain which it excites, and the lameness with which it is attended, but by the deformity which it produces, and which is always obvious on comparing both knee-joints together.

When the patella is dislocated at the same time with the tibia and fibula, it will, for the most part, be reduced along with these bones; but when this does not happen, it may be afterwards replaced in the manner I have mentioned in the last Section.

Luxations of this joint are to be reduced by fixing the thigh with sufficient firmness, and extending the leg till the ends of the bones are entirely clear of each other; when the tibia and fibula will be easily replaced. In partial luxations, the degree of extension necessary for this will be inconsiderable; but where the bones are completely displaced, more



force will be required. It is scarcely necessary to observe, that the muscles of the leg should be as much relaxed as possible while the force for extending it is applying.

Scarcely any joint is so apt to suffer from inflammation as that of the knee; so that in all such injuries as this, where the surrounding soft parts are so liable to inflame and become painful, the most strict antiphlogistic course becomes requisite; local blood-letting should be prescribed, and repeated according to the violence of the symptoms and strength of the patient; and the limb should for a considerable time be kept at perfect rest.

The upper as well as the under end of the fibula is sometimes forcibly separated from the tibia. As the symptoms which this excites are similar to those which occur from sprains of the muscles, the nature of the injury is often overlooked. I may almost always, however, be distinguished by attentive manual examination.

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The only method of obtaining relief is by replacing the bone, which for the most part is easily done, and retaining it with a proper bandage till the parts have recovered their tone.

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## SECTION XVI.

*Of Luxations of the Foot at the Joint of the Ankle.*

THE joint of the ankle is formed by the upper part of the astragalus or first bone of the foot, being received into a cavity in the under end of the tibia; which is bounded externally by the end of the fibula projecting a considerable way past the end of the tibia.

The astragalus may be dislocated either backward or forward, outward or inward, but it is more frequently pushed inward than in any other direction. The great strength of the tendo achillis prevents it from slipping easily backward, and it has also some effect in preventing it from going forward. It cannot be pushed outward

ward without breaking the projecting end of the fibula.

Dislocations of this joint are in general easily discovered by the pain and lameness which they produce, as well as by the obvious alteration which they occasion in the appearance of the foot. When the astragalus is pushed forward, the foot appears to be lengthened and the heel shortened; when pushed backward, the foot is shortened and the heel lengthened; and when luxated, either outwardly or inwardly, there is always a preternatural vacancy on one side of the joint, and a promi- nency on the other.

In the reduction of this luxation, the patient should be placed either upon a table or on a bed, and the leg, with the knee bent, should be firmly secured by an assistant or two. The foot is now to be put into that situation which tends most effectually to relax all the muscles that belong to it; and being given to an assistant, he must be desired to extend it in that direction till the most prominent point

of the astragalus has clearly passed the end of the tibia, when the bone will either slip into its place, or may be easily forced into it.

As the upper part of the astragalus is not perfectly round, but rather somewhat hollow, this joint is more apt to be partially luxated than any other formed by a ball and socket, as this in some measure is: Partial luxations of it, however, are easily reduced.

Besides the antiphlogistic course that I have advised after all luxations of the large joints, it is particularly necessary in luxations of the ankle to keep the limb for a considerable time at the most perfect rest, especially where the under extremity of the fibula is broken, by the foot being forced outward; for, as the stability of the joint depends in a great measure on this bone, if it be not either rightly replaced or retained in its situation, till the cure of the fracture is effected, it may afterwards continue weak during life, or be attended with stiffness  
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and a great degree of pain. The weakness that succeeds to this kind of injury, if it be not removed by these measures, will be most effectually obviated by a firm splint of thin iron connected with the shoe, and applied along the outside of the leg; or by an instrument invented by the late Mr Gooch, represented in Plate XCII. fig. 4.

## SECTION XVII,

*Of Luxations of the Os Calcis and other Bones  
of the Foot.*

**T**HE os calcis, which is the largest bone of the foot, is sometimes dislocated laterally, where it is connected with the astragalus. It is prevented from being pushed forward by the other bones of the foot; and the tendo achillis, which is inserted into a large rough process of this bone which projects backward and forms the heel, prevents it from being luxated in this direction.

The astragalus and os calcis are sometimes luxated at their junction with the naviculare and os cuboides; and as the joint, if it may be so termed, is at no great distance from the ankle, this variety of luxation has, in some instances, been mistaken

taken for luxation of the ankle. The foot may at this part be pushed either outward or inward, or be forced directly downward: It will rarely be luxated upward, as it can scarcely be exposed to external violence in such a direction as could have this effect.

Luxations of any of these bones are readily discovered by the pain and lameness with which they are always attended; as well as by the alteration which they produce on the shape of the foot.

The os calcis, when completely displaced, is more difficult to reduce than almost any other bone of the foot: It can only be done by fixing the leg and foot in such a position as tends most effectually to relax the different muscles that belong to them; and while they are in this position, by endeavouring to force the bone into its situation; and this will be more readily done, if during the operation the foot is extended.

In luxations of the astragalus and os calcis with the os naviculare and os cuboides, as the anterior part of the foot is apt to be



be drawn towards the heel, it becomes necessary to extend it to such a degree as may clear the bones on the opposite sides of the joint of each other ; for till this is done, the reduction cannot take place, while the bones will immediately slip into their situation as soon as they are drawn past each other.

The other three bones of the tarsus, usually termed the Cuneiform Bones, as well as the Metatarsal Bones, and the Bones of the Toes, are all liable to be luxated, and they may be displaced almost in every direction. But it is not necessary to speak of the method of reducing them ; for the observations that I had occasion to make on dislocations of the bones of the hand are equally applicable here : so that I shall now refer to what was said on that subject in the twelfth Section of this Chapter.

CHAP-

## CHAPTER XLI.

### *Of DISTORTED LIMBS.*

**L**IMBS may be distorted in various ways, and by different causes; either from a morbid state of the bones, or from a contracted state of the muscles, or the bones and muscles may both be affected. In some cases, distortions are owing to original mal-conformation; in others, they arise in infancy, and in some, at more advanced periods of life.

For a considerable time after birth, the bones are soft and pliable, and are easily affected by the postures of the body. The  
bones

bones of the legs are apt to be crooked by children being made to walk too early. This also is the effect of some diseases, particularly of rickets, which soften the bones so much that they easily yield to the posture of the body, as well as to the ordinary action of the muscles. But the most frequent cause of distorted limbs is that contraction of the flexor muscles of the leg and fore-arm, which is often induced by an inflamed state of the knee and elbow, and of which we have a very common example in those cases of white swelling to which these joints are more particularly liable. As the limb lies in greatest ease while the muscles are relaxed, the patient naturally keeps it always bent; and when this posture is long continued, it almost constantly terminates in such a contracted state of the flexor tendons, as keeps the under part of the limb at an angle with the superior part of it: Of this we meet with daily instances in the leg; where from this cause alone a patient is

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is often altogether deprived of the use of his limb.

As it has been a prevailing opinion among practitioners, that little advantage is to be derived from any remedies that we can employ for distorted limbs, they have seldom made any attempt to cure them: In consequence of which, this branch of practice has been almost universally trusted to itinerants or to professed bone-setters. In this, however, we are wrong; and in saying so, I can speak with confidence, founded on much experience: Having early in life observed the misery to which patients with distorted limbs were reduced, I was resolved to make some attempts for the relief of such as might apply to me, however small the chance might be of succeeding; and in various instances I have had the satisfaction of relieving, and in some cases of curing completely, patients who had been lame for several years, and where it was not expected that any thing could be done for their advantage. Where an anchylosis  
is

dom. All the contracted muscles and tendons, from their origin to their insertion, must be well rubbed for at least half an hour three times a-day ; and the limb should be kept constantly moist with, as it were immersed in, the emollient, being covered with flannel well soaked in it at every repetition of the friction. While the frictions are applying, the limb should be slowly, though firmly, extended to as great a degree as the patient can easily bear ; and the instrument represented in Plate XCI. may be afterwards applied, in order to prevent the muscles from contracting.

It is necessary, however, to remark, that this extension should not be made quickly : By doing so, much harm has been done, inasmuch that joints have become pained and inflamed, where there was no previously any other disease than stiffness of the flexor muscles ; while it may be done with the utmost safety in the gradual manner I have mentioned. In the ordinary way, indeed, several months may be required

quired for effecting what a greater force might accomplish in as many weeks; but the latter must always be attended with pain and hazard, while with the other we proceed with ease and safety.

Even where extension is not necessary, the effects of emollients are often conspicuous. We frequently meet with stiff joints, particularly in the ankle, without any contraction or distortion of the limb. In this case, emollients alone, if duly continued, will commonly relax them sufficiently.

Every kind of greasy application proves useful here, but animal fats answer better than vegetable oils. The grease of geese and ducks and other fowls answers well; also hogs-lard, and the oil obtained from boiling recent bones of beef and mutton in water. Butchers usually keep this oil in quantities: When properly prepared, it is quite pure and transparent, and has no smell.

When the distortion of a limb proceeds from a bone being bent, if this is not of

long duration, and especially when it occurs in childhood, we may frequently remove or lessen it by constant pressure gradually increased on the convex side of the limb, till the bone is brought into its natural direction.

This kind of deformity often occurs in patients labouring under rickets; but we find it most frequent in new-born children, either from original mal-conformation, or from some singularity in the situation of the child while in the womb. It is most frequent in the legs, when it also affects the direction of the feet and ankles. When ~~the bones~~ of the leg are bent outward, the ~~foot~~ is turned inward; and, vice versâ, the ~~foot~~ is turned outward when the leg is bent inward. Patients affected in this last manner are called Valgi; and Vari when the feet are turned inward.

These distortions of the feet and ankles, have been supposed to originate in almost every instance from mal-conformation in the bones forming the joint of the ankle; and the means that have been proposed  
for

for removing them, have been meant to produce an alteration of that joint : They may in some cases arise from this cause, but I have scarcely met with it. At first view of the disease, we are indeed apt to imagine that the fault lies chiefly in the ankle ; but it will be very universally found, as I have just observed, to proceed from the form of the leg. When the leg is bent outward, the toes are turned inward, and the side of the foot downward ; or, if the curvature of the leg is considerable, the sole of the foot will be turned nearly altogether upward, while the top of the foot will rest on the ground on every attempt to walk : And, on the contrary, when the bones of the leg are bent inward, the toes and sole of the foot will be turned outward and upward.

Whoever will examine with attention the effect produced upon the foot by the bones of the leg being curved in the manner I have described, will find, that the maladies we are now considering must necessarily result from it ; and although it



may occasionally happen, that the joint of the ankle is affected by a long continuance of the distortion, yet in almost every instance, the disease will be found to proceed originally from the cause I have mentioned: So that in the cure, our views should be chiefly directed to this affection of the leg. By removing the curvature of the bones, the foot will gradually regain its natural situation, while all our endeavours will fail, if we only attempt to alter the direction of the ankle-joint.

When the foot and toes are turned inward, solely from a mal-conformation of the ankle-joint, we ought no doubt to endeavour to give the joint a better direction; but as I never met with an instance of this, I must leave the particular mode of effecting it to those who may happen to see it. The best method of applying pressure to the bones of the leg when bent, is by fixing a firm splint of iron in the shoe, on the concave side of the leg; and if the head of the splint be made to rest against the corresponding condyle of the femur,  
and

and the other end of it on the foot, an easy gradual pressure may be made upon the opposite side of the leg, by one or two broad straps passed round both the leg and the splint. If the splint is covered with soft leather, and properly fitted to the parts, it gives no uneasiness; and by drawing the strap surrounding it with the leg tighter from time to time, the pressure is increased in the gradual manner I have mentioned. In Plate XCII. figures 1, 2. and 3. an apparatus is represented; which in different cases, where the curvature of the leg was very considerable, and where the sole of the foot was turned almost entirely upwards, answered the purpose completely. It proves sometimes sufficient to fix the small end of the splint in the shoe, and the broad flat pad at the top on the condyle of the femur. A splint for this purpose is represented in fig. 2. This gives it two fixed points, by which we have it in our power to make any necessary pressure with the straps passed round the leg: But in some instances, as was the

case in two of those, to which I allude, the sole of the foot could not be kept so much down as to admit of this, without fixing the shoe to a frame, as is represented in fig. 3., for in all such cases the sole of the foot should be kept as much as possible in a natural situation, otherwise the pressure made upon the leg for removing the curvature in the bones is apt to give a wrong direction to the joint of the ankle, by the under end of the splint being necessarily made to rest on it.

I have thus given a general view of the nature of this affection, and of the management best adapted for removing it: but whether limbs are distorted from a contracted state of the muscles that belong to them, or from a curvature in the bones, much variety must occur in the application of the remedy, particularly in the manner of applying the extension. The treatment, indeed, that suits one case best, is seldom exactly applicable to another: It must therefore be varied according to the judgment of the practitioner.

Other

Other means have been proposed for removing curvatures in bones: Of these the best I have seen is an invention of a late ingenious artist of this place, Mr Gavin Wilson, who was long much employed in this branch of business. In Plate XCIII. fig. 1. and 2. I have represented one of Mr Wilson's instruments for distortions of the leg.

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## CHAPTER XLII.

### *Of DISTORTIONS of the SPINE.*

**T**HE spine may be distorted in various directions; outwardly, inwardly, and laterally; and in some cases it happens in all of these directions in the same person. This sometimes arises from external violence; but more frequently as a symptom of a delicate frame.

Besides the deformity which these distortions produce, they are apt to injure the health, by compressing the abdominal and thoracic viscera, and inducing paralytic affections of the lower extremities,  
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in consequence of the pressure which they produce on the nerves of those parts. They occur in all ages ; but more frequently about puberty than at any other period, and more commonly in girls than in boys. In general, their effects are observed before the cause is suspected ; for there is seldom much pain in the distorted part.

When distortion of the spine occurs during infancy, the patient appears to be suddenly deprived of the use of his limbs ; but at more advanced periods, he complains first of feebleness and languor, and of numbness or want of feeling in the under extremities. By degrees this want of sensibility is found to increase ; and he is often observed to stumble and to drag his legs instead of lifting them cleverly, nor can he stand erect for any length of time but with much difficulty. At last he loses the use of his legs entirely, which become altogether paralytic ; and when the spine is distorted forward, so as to compress the thoracic and abdominal viscera, he becomes

comes distressed with dyspnœa, or with complaints in the stomach and bowels, according to the part of the spine that is diseased.

In some the loss of power in the extremities takes place in the course of a few days from the first approach of the disease; and it sometimes becomes gradually less, although it never is, so far as I have observed, entirely removed.

On the deformity being discovered, we sometimes find that one of the vertebræ only is displaced: Sometimes two or more are affected; and in some cases it appears to arise solely from a thickening of the ligaments connecting the vertebræ together, without any particular affection of the bones. When one of the vertebræ only is displaced, the patient is usually more completely deprived of the power of his limbs than when two or more of them are displaced, owing perhaps to the angle being more acute, and consequently the pressure on the medulla spinalis more considerable when one bone only is thrown  
out

out of the range. This also accounts for the paralytic symptoms being in some instances less remarkable in more advanced stages of the disease than they were at first; for although one bone only may be displaced at first, yet one or both of the contiguous vertebræ almost constantly yield at last; and the difference arising from this is so great, that patients almost always linger and die in the course of a year or two, often in less time, when one bone only is deranged; while they live for a great length of time, frequently as long as if no such circumstance had occurred, when the curvature of the spine becomes more extensive.

As distortions of the spine often proceed from delicate weakly patients, indulging too much in particular postures, every habit of this kind should be avoided on the first appearance of the disease. If the patient has been accustomed to lean much to one side, the reverse of this should be advised; and that the body may lie as much as possible upon an equal surface during



during sleep, he ought to use a hair matress laid upon boards instead of a bed of feathers or down.

By attention to these points; by the use of an invigorating diet; the cold bath, bark, and other tonics; the disease has been in some cases prevented from advancing so far as it otherwise probably would have done: But where any of the bones have been affected, I have never seen an instance of a complete cure being obtained. Mr Pott, to whose observations upon this subject we are much indebted, speaks highly of the effect of issues placed as near as possible to the tumor. He advises an issue to be opened with caustic on each side of the tumor, large enough to admit a kidney-bean, and the bottom of the sore to be sprinkled from time to time with powder of cantharides. This I have practised in various cases, and in some instances with obvious good effects: But in all of these there was reason to suppose that the seat of the disease was in the ligaments only, and not in the bones of the spine.

spine. When they have appeared to prove useful where the bones have been affected, I conclude that the mitigation of symptoms has arisen from the cause I have mentioned, the pressure upon the spinal marrow being lessened in the progress of the disease.

Various machines have been invented for the removal of distortions of the spine by pressure: All of these, however, do harm, and ought never to be used. It must at once appear, to whoever is acquainted with the anatomy of these parts, and with the nature of this disease, that the displaced bone is never to be forcibly pushed into its situation; and if this cannot be done, it is obvious that no advantage is to be derived from the practice, while it is evident that much harm may ensue from it.

In all distortions of the spine, it is an object of the first importance to support the head and shoulders. If this is neglected, the weight of the head tends almost constantly to increase the curvature.

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The collar usually employed for this purpose answers nearly as well as any other. In Plate XCIV. fig. 1. a representation is given of one with some improvements, by which both the head and shoulders may be very effectually supported; and in fig. 3. another is delineated for supporting the shoulders only.

C H A P.

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CHAPTER XLIII.*Of NECROSIS.*

**T**ILL lately little was understood of this very singular disease: Not from its being new, or that it has only lately made its appearance, for it seems to depend on causes that have probably existed equally in all ages; but from its having been confounded with other diseases, from which however it is widely different.

We meet with many detached observations on this disease, in the works of Hildanus, Cheselden, Gooch, Hunter and others, but my friend Mr Russell was the first

first who gave a regular systematic account of it : The description indeed that he gives of it is so full, clear, and perspicuous, that scarcely any thing new is left for others to add to it \*.

The term Necrosis, is derived from the Greek word *Νεκρος*, Mortuus ; in allusion to one of the most remarkable circumstances of the disease, which consists in the spontaneous death of one bone, and the reproduction of another, the last of which is in part formed before the other can separate.

The old bone, which separates, and commonly comes away either dissolved in the form of matter, or in one or more pieces, is termed the Sequestra, and it is always surrounded by and included in the new one, so that the new bone must be larger in circumference, though not longer than the other. This being the case, we would naturally suppose that those tendons of muscles

\* *Vide* A Practical Essay, on a certain disease of the bones, termed Necrosis, illustrated with six plates, by James Russell, F. R. S. Surgeon, Edinburgh.

muscles which were originally inserted into that portion of the old bone that is now destroyed, would completely lose their influence: But it is quite otherwise; for we find, that they possess their relative situation in the newly-formed bone, into which they are inserted by the ossification of a gelatinous fluid poured forth around them. The new bone which is thus produced, appears to be possessed of all the essential properties of the original. It is not indeed so regular in its external appearance, nor internal structure, for it is not lamellated, but it can set out ossific granulations; it may exfoliate, and it performs all the functions peculiar to an original bone.

From all the experiments and observations that have hitherto been made on the subject, it seems to be probable that the periosteum is no way concerned in the production of the new bone; that it does not furnish granulations for its increase; that destruction of the marrow does not naturally follow an attack of

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necrosis; but that this process never takes place without a previous state of inflammation.

The symptoms attending necrosis are the following: First, There is a deep-seated pain in the limb; and inflammation and suppuration take place: The matter thus formed discharges itself in one or more openings in the most prominent parts of the limb, and these openings communicate with sinuses that commonly go to the depth of the bone: The matter for the most part is good, though copious, and it cannot be increased in quantity by pressure.

The sequestra is not always discovered by the probe, and the sore sometimes heals without the fore sometime off; at other times, however, when the inflammation is severe, the sequestra is thrown off quickly, which commonly excites a temporary loss of power of the whole limb: But in general the inflammation is slight; the process of separation goes

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goes on slowly ; and the patient retains the motion and use of his limb.

In the course of the disease, the fores frequently heal and break out again, and holes form in the newly-formed bone corresponding with the sinous openings on the surface : It has been found, that in this disease even joints are regenerated, and in that case the cartilage is always larger than in the original sequestra ; this has taken place in the lower jaw, where new sockets are formed for the teeth which have been retained.

The progress of necrosis is always tedious ; in some it will be over in the course of a few months ; but in a great proportion of cases it goes on for two or three years.

We chiefly meet with necrosis in infancy and early youth, and more frequently in the lower jaw and in the bones of the leg than in any other part of the body.

The most obvious predisposing causes of necrosis are lues venerea, and a scrofu-



lous diathesis; and in some instances we can trace the exciting cause to an external accident, as a blow or a bruise.

The diseases for which necrosis may be mistaken are the following: Caries of a bone produced by inflammation or collections of matter without exposure to the external air; and it may be mistaken for the exfoliation of an external lamella of a bone: but in the latter the internal surface is smoother, the matter is thin and fetid, and the granulations less firm and more extensive than in necrosis.

The danger arising from necrosis is in a great measure to be estimated from the degree of inflammation and fever that takes place: It seldom proves dangerous, and where these symptoms are moderate, the patient is able in a great proportion of cases to conduct his ordinary business without confinement; but when he becomes hectic, as sometimes happens, immediate amputation of the limb is perhaps the only remedy to be trusted.

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In the cure of necrosis, no general treatment proves of any avail, and there is reason to think, when the sequestra separate easily, that the interference of art should never be advised. If it be not indeed in certain circumstances, it is perhaps our best practice to do nothing in the whole course of the disease but to obviate particular symptoms.

When the pain is severe, local blood-letting and the general effects of anti-phlogistic remedies, as I have already observed, are to be chiefly depended on. When matter is formed and is found to lodge in any of the soft parts of the limb, it ought to be discharged by small openings, and the strength of the patient requires to be supported by due attention to a well-regulated diet, as otherwise it is apt to sink by the long duration of the disease.

In this manner a cure is frequently obtained without any farther assistance from art, that is, the sequestra either dissolves and comes away insensibly in the

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matter

matter discharged from the sore ; or it comes off in one or more pieces ; or the irritation that it excites becomes considerable, and the sores at last heal, while the sequestra still continues surrounded with the newly-formed bone. The limb is larger than the other, and commonly somewhat deformed by inequalities on the surface of the bone ; but under these inconveniencies the patient sometimes escapes without much pain, and with little or no injury to his constitution.

It sometimes, however, happens, that the sequestra does not come away, while at the same time it creates so much irritation, that fever takes place, by which, and by a profuse discharge of matter from the sores, the health of the patient is brought into hazard : In this situation, an attempt should either be made to remove the sequestra by a surgical operation, or immediate amputation of the limb should be advised.

If any part of the sequestra appears it may be right to endeavour to save the  
limb

limb by taking it away ; but where no part of the old bone is discovered, under all the uncertainty of the exact situation and state in which it may be, together with the risk of increasing, by this operation the state of irritation over the whole limb, it will probably, in the course of further experience, appear to be our best practice, in such circumstances, to advise the limb to be amputated.

The operation for removing the sequestra is done in the following manner : A longitudinal incision is made through all the soft parts covering the diseased bone : In this manner the bone must be laid completely bare, but if the teguments are found, no part of them should be removed.

If the sequestra is discovered by any holes in the newly-formed bone, and if these are very near to one another, an opening sufficiently large for taking it out may be made with a large scalpel or a sharp chisel and mallet ; but it shakes the limb less, and gives less pain to the

patient, to do it with reiterated applications of the trephine, and afterwards to cut out with a firm scalpel, such small portions of the bone as the saw may have left. In the event of no opening in the new bone being met with, small holes may be drilled in it with the perforator of a trepan. In this manner the state of the sequestra may be discovered, when by the operation that I have already described, with the head of the trepan, an opening may be made in the new bone of a sufficient size for removing the other. This, however, as I have already observed, is an operation necessarily attended with uncertainty and hazard, so that in a great proportion of cases, it will probably be found to be a safer practice to amputate the limb.

After the sequestra is removed, mild dressings should be applied: emollient poultices and an antiphlogistic regimen prove useful, while symptoms of inflammation take place; by which, and a due attention to regimen, the sore will heal easily, when  
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the health is otherwise good : The cure, however, proves always tedious, being seldom completed in less than six months, and as the limb should be kept during the whole period at perfect rest, and as much as possible in the same position, the confinement is necessarily of the most distressful nature.

This, together with the uncertainty and hazard of the operation for removing the sequestra when no part of it appears, makes me conclude, as I have observed already, that in all such circumstances it is perhaps our best practice rather to amputate the limb.

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## CHAPTER XLIV.

### *Of AMPUTATION.*

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#### SECTION I.

#### *General Remarks on the Operation of Amputation,*

**B**Y the term Amputation, we usually understand the removal of the whole or part of a limb. We speak of the Extirpation of a tumor; of the mamma; of a testis: But we say the Amputation of a leg and of an arm.

The mutilation, produced by this operation, renders it one of the most dreadful in the practice of surgery; yet as the only means by which life can be saved,

ved, it is frequently necessary. It is an operation, however, so repugnant to humanity, so distressful to the unfortunate sufferer, and in some circumstances so fraught with danger, that nothing but a clear conviction of this necessity can warrant our proposing it in any case.

The operation, indeed, is not difficult : Every practitioner accustomed to handle instruments may perform it. But to distinguish with precision the cases which require it, from those which might do well under a different treatment, and to determine the particular periods of each when it ought to be performed, are circumstances which require more deliberation than perhaps any other in surgery : I shall therefore enumerate the causes which may render amputation necessary, before proceeding to describe the method of performing it.

S E C.



## SECTION II.

*Of the Causes which may render Amputation necessary.*

**T**HIS operation may be rendered necessary by various causes ; all of which may be comprehended under the following heads.

1. Bad compound fractures.
2. Extensive lacerated and contused wounds.
3. A portion of a limb being carried off by a cannon-ball, or in any other manner, if the bones are unequally broken and not properly covered.
4. Extensive mortification.
5. White

5. White-swellings of the joints.
6. Large exostoses, whether they are confined to joints, or spread over the whole bone or bones of a limb.
7. Extensive caries, accompanied with bad ulcers of the contiguous soft parts.
8. Cancer, and other ulcers of an inveterate nature.
9. Various kinds of tumors.
10. Particular distortions of a limb.
11. Necrosis.

Each of these causes I shall consider in the order in which they are mentioned.

In Chapter XXXIX. Section XVI., I had occasion to speak particularly of compound fractures : I shall at present therefore only remark, as the substance of what was then fully pointed out, that in  
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the army and navy; where ordinary patients cannot be duly attended, and where they must be much jolted, and often removed from place to place, immediate amputation should be advised in all cases of bad compound fractures. Cases will often indeed occur even in the worst situations, in which it will be improper to amputate the limbs. Thus, where little violence has been done, and where the bones have been broken so much in a transverse direction, that when replaced they support each other with firmness, and especially if one bone only is broken, it would no doubt be a severe, and often an unnecessary measure, to propose the removal of the limb. But whenever much violence has been done to a limb; when the bones are broken in such a manner that they do not, even when exactly replaced, support each other firmly, and when the fleshy parts that cover them are much torn; in all such situations, I consider it as a good general rule to advise immediate amputation. Unless the operation, however, can be performed

formed soon after the accident, it cannot again be admissible for a considerable time; for whenever a limb has become swelled and inflamed, it can never, but with the utmost danger, be taken off till these symptoms subside.

In private practice, however, where the patient can from the first be placed in an easy comfortable situation, from which he need not be removed till his cure is completed; where he can be kept perfectly quiet, and have all the advantages of good air, a proper regimen, and the assistance of able practitioners, very few cases will occur in which immediate amputation should be advised. The only cause, as I have elsewhere observed, which in such circumstances can render immediate amputation proper, is the bones of a limb, together with the muscles and other soft parts with which it is covered, being so shattered and bruised that there will be no chance of the limb being rendered useful by any attempt that might be made to save it: In such circumstances, it should be  
removed

removed immediately ; but this not being done, the operation, as I have observed above, should be delayed, till the swelling, inflammation, and fever induced by the accident, are removed.

Although early amputation, however, is seldom necessary in private practice, yet, in the after-treatment of compound fractures, it is sometimes proper :

1. In consequence of profuse hæmorrhagies which cannot be otherwise stopped. These sometimes happen from one or more arteries being cut by the ends of the fractured bones, as well as from other causes.

2. In consequence of extensive mortification. This we shall have occasion to consider more particularly in speaking of mortification as one of the general causes of amputation.

And, 3. By the ends of the fractured bones remaining long disunited, attended with the discharge of such large quantities of matter, that the patient runs some risk of sinking under it.

I have elsewhere observed, that the union of fractured bones is sometimes prevented by a loose portion of bone being left which ought to have been removed; and nothing more readily keeps up a profuse discharge of matter: But when all such pieces of bone have been removed; when no union takes place; or when the discharge still continues in such quantities as to weaken the patient notwithstanding of all that can be done to prevent it; such as preserving the limb steadily in one posture, regular dressing of the sore, a nourishing diet, and a plentiful use of bark; nothing will in such circumstances so certainly save the patient as the removal of his limb.

2. I mentioned extensive laceration and contused wounds as the second general cause of amputation. Wounds not accompanied with fractures of the contiguous bones are seldom so bad as to require amputation in any stage of them: But when a limb is so severely lacerated or contused as to have all the large bloodvessels that

belong to it destroyed, so as to leave no ground of hope that the circulation can be preserved in it, immediate amputation should be advised, whether the bone is safe or not. As in such circumstances no effort on the part of the practitioner could save the limb ; and as wounds of this description are more apt to terminate in mortification than any other, the sooner the operation is performed the better.

It will also happen in lacerated and contused wounds, that amputation may be afterwards necessary, although it did not appear to be so at first. In this respect they are similar to compound fractures, and the same observations will apply to them. Hemorrhagies may occur which cannot be stopped ; extensive mortification may take place ; and such large quantities of matter may form, that the patient will not be able to bear up under the discharge. In any of these events, we have to consider the removal of the limb as the only remedy.

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3. The removal of a portion of a limb by a cannon-ball or other violence, was mentioned as the third general cause of amputation.

This is one of those cases which many contend can never require amputation: for the limb being already removed, it will be better, they allege, to endeavour to heal the fore, than to add to the pain and danger of the patient by an operation. The argument is plausible, but it will not bear examination.

In wounds of this kind, the bones are commonly much shattered, and even splintered; and the muscles and tendons are left of unequal lengths, and much lacerated and contused. In this situation it is allowed by all, that the separate pieces of bone, as well as the sharp ends of the remaining bone, should be removed, together with the ragged extremities of the muscles and tendons. Now all this could seldom, I believe, be done in less time than the operation of amputation; while by amputating above the injured part, and covering



vering the bone with sound muscles and skin, we diminish the fore so much that it would probably heal in a third part of the time that the original wound would require; at the same time that the patient will have a good stump, which in the other method never could be the case: With me this last argument of itself would be sufficient for advising the operation under the circumstances we are considering: For, as I do not suppose it would add to the danger, any additional momentary pain it might occasion, would be amply compensated by the advantage he would afterwards derive from it. When the practitioner has it in his power, the operation should be advised immediately; for, however necessary it might be, many patients would not afterwards have sufficient firmness of mind to submit to it; and, from ignorance of the advantages to be derived from it, would prefer present ease, to future conveniency and advantages, however great they might be.

#### 4. Mortification

4. Mortification is the next cause we have to consider by which amputation may become necessary. They who are determined to oppose the practice of amputation as much as possible, affect to consider it as unnecessary even in mortification: all the lesser degrees of it, they observe, may be cured; and when very extensive, the patient, they allege, will commonly fall a sacrifice to the disease, whether the operation is performed or not. This opinion, however, is so directly contrary to fact, and to the experience of every unprejudiced practitioner, that I need not attempt to refute it: For although it would be highly improper to advise the removal of a limb in slight degrees of gangrene; yet when mortification has spread so extensively as to destroy all or even a great proportion of the soft parts of a limb, an occurrence too frequently met with, what remedy could be employed instead of it? As I know of none, and as I never heard of any that in any way could prove useful, I shall conclude, that

in mortification proceeding to such an extent as I have mentioned, amputation of the limb becomes indispensable.

But although this doctrine will be generally admitted, yet practitioners are not agreed with respect to the period of mortification at which the operation should be performed. Some contend, that in almost every case of gangrene, and especially where it proceeds from external violence, the limb should be amputated as soon as mortification is evidently formed, and while it continues to spread: Others are of opinion, that amputation should never be advised till the gangrene is not only stopped, but till the gangrenous parts are separated from the sound.

Those who advise immediate amputation observe, that by taking the limb off above the diseased part, we may prevent the progress of the mortification, and may thus save the patient. Although the argument is specious, it does not appear to be well founded; and so far as my observation goes, I would say that it  
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is a practice fraught with danger, and ought universally to be discarded: For however attentive we may be in amputating at a part of the limb that appears to be sound, even the most experienced practitioner will be liable to be deceived. The skin may be perfectly sound, and may be free from pain, inflammation, and swelling; and yet the deep-seated muscles, and other parts contiguous to the bone, may be in a state of gangrene. Of this I have seen various instances: But even where the whole divided parts are found to be entirely sound, if the operation is performed while mortification is advancing, the disease seldom fails of seizing the stump; at least, I never knew an instance of the contrary, and I have unfortunately been concerned in different cases where this practice was adopted. On conversing with practitioners, who, from peculiarity of situation, have much employment in those accidents which are most apt to terminate in gangrene, I also find that their

experience tends to support this opinion : It was also the decided opinion of the late Mr Sharpe, and Mr Pott, and of every modern practitioner of observation \*. I think it right to mention this, as attempts have of late years been made by some speculative practitioners to introduce a contrary practice ; which if admitted, there is much reason to suspect would prove extremely hurtful, although from its proving so universally unsuccessful, there is reason to hope that it will soon be laid aside, even by those who at present patronize it.

I would not think it necessary, however, to delay the operation so long as is advised by some, and particularly by Mr Sharpe ; who thinks that it should never be performed till the separation of the mortified parts is considerably advanced.

\* Mr Pott's words upon this point are very strong :  
 “ I have more than once seen the experiment made of  
 “ amputating after a gangrene has been begun ; but I  
 “ never saw it succeed ;—It has always hurried the pa-  
 “ tient's destruction.”—Vide Remarks on Fractures, &c.

ced \*. As Mr Sharpe was a man of much experience, his observation may prove to be well founded ; but so far as I have yet seen, I would consider it as sufficient to wait till the mortification is completely stopped, but not much longer : In this manner, we seem to reap all the advantages which the caution that I have advised can give ; and the earlier after this that the mortified parts are removed, the more readily we prevent the system from suffering by the absorption of that putrescent matter which a gangrenous mass universally yields.

The opinion that I have given relates to every variety of gangrene. In whatever way it may have arisen, the practice should be the same : For although some stress has been commonly laid upon the circumstance of its proceeding from an internal or external cause, yet no utility is derived from this. The operation should in no instance be advised till the period I have

\* Vide Treatise on the Operations of Surgery, Chapter xxxvii.

have mentioned ; and at that time, whatever may have been the cause of the disease, no delay should be admitted.

5. In mentioning white-swellings of the joints as a cause of amputation, I must refer to Chapter II. Section III. § 10., for the management of the disease, as well as for a more particular account of those symptoms that more especially indicate the operation. At present I have only to observe, that as long as there is the least reason to hope that by any means the limb may be saved without hazard to the patient, the operation should never be advised. As a farther motive for this, I may remark, in addition to what I have in various parts of this work done already, that amputation, more frequently succeeds, that is, a greater proportion recover from the operation when it is delayed till the patient is considerably reduced by the disease, than when it is performed in the more early part of it. The cause of this may be nearly the same as what I have given in Chapter XXXIX., Section XVI.,  
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when advising late Amputation in some circumstances of Compound Fractures.

6. In Chap. II. Sect. III., I entered upon the consideration of the various kinds of exostosis; so that at present I have only to remark, that when a diseased portion of bone cannot be taken out in the manner I have formerly advised, and when the tumor is either hurting the patient's health or has become unsupportable from its size or any other circumstance, amputation of the limb, when no particular reason prevents it, should be advised as the only remedy.

7. The next cause that I have mentioned of amputation, is an extensive caries attended with ulcers of the contiguous parts. When speaking of caries, in the seventh Section of Chapter V., I pointed out the different means employed for the cure of the disease, that is, for promoting an exfoliation of the diseased part of the bone. In addition to what I had then occasion to say, it may be observed, that although an extensive caries is in general considered  
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of itself as a sufficient reason for amputating a limb, yet it certainly should be admitted under much restriction. However extensive a caries may be, even although it occupies the whole length of a bone, it may be in many instances removed; and we have many on record of deficiencies produced in this manner being amply supplied by a regeneration of bone: So that where the constitution is sound, and more especially when the patient is young, a carious bone will seldom of itself be a sufficient motive for removing a limb, at least the chance of saving it by removing the diseased bone should first be given. But when a carious bone is conjoined with deep and extensive ulcers of the corresponding soft parts, which might give much cause to suspect that a cure would not be obtained even although the diseased bone should be taken out, amputation should be preferred; for in this situation, besides the difficulty of healing the sores, the formation of any considerable quantity of bone would  
be

be very uncertain, and therefore the risk should not be incurred.

8. The next cause to which we have to advert, by which amputation may become necessary, is cancer, and other ulcers of an inveterate nature.

When speaking of Cancer in Chapter V. Section VIII., I endeavoured to show, that no dependence is to be placed either upon internal medicines or outward applications for a cure ; and that the removal of the diseased part is alone to be trusted. It must be acknowledged that cancer does not frequently occur in the extremities : But every practitioner must have seen it on different parts of them ; and wherever it appears, the removal of the diseased parts with the knife should be advised immediately. They may be often taken away without amputating the limb ; but when the disease has attacked the ligaments or bones, and especially when the sore is extensive, nothing but the removal of the limb above the parts diseased ought to be trusted, In such circumstances, I  
have

have known attempts made to save the limb, but never with success. Even the removal of the limb will sometimes fail; but I have known it answer where the disease had returned after being removed in the usual way.

Besides cancer, other ulcers may, in particular circumstances, render amputation necessary: Where an extensive ulcer, not induced by any general affection of the system, is hurting the health of a patient; and when, instead of yielding to the usual remedies, it becomes more extensive and more inveterate, as it might at last proceed so far as to endanger life, we ought rather to advise the limb to be taken off. Such ulcers as are usually termed Phagadenic, sometimes terminate in this fatal manner: But this termination is most frequent in sinuous ulcers; such as arise from deep-seated abscesses, where the matter has found access between the interstices of the large muscles, and where, notwithstanding all our endeavours, the discharge continues  
to

to be so profuse as to endanger the life of the patient.

9. Various kinds of tumors may render amputation necessary.

Encysted tumors seldom lead to this necessity; but in some instances where they are deep-seated, originating perhaps from the periosteum, when they are allowed to remain till they acquire a great bulk, all the contiguous parts come to be so much injured, that nothing but the removal of the limb will answer any good purpose. In some cases, by long-continued pressure from the tumor, the contiguous bones not only become carious, but are altogether dissolved; at the same time that the cellular substance, and even the muscles of the limb, become so much diseased as to give no cause to hope that we could be able to save them.

We sometimes find a portion of a limb considerably enlarged, with an uniform hardness in some parts, and in others a degree of softness that gives cause to suspect that a fluid is collected beneath. The  
skin

skin at first retains its natural colour ; but at last acquires a livid hue. The commencement of the disease is not attended with pain ; but at last it not only becomes painful, but extremely troublesome from its weight. It usually begins without any evident cause, and often in people who are otherwise healthy : At first the swelling commonly appears on the inferior part of a limb, and proceeds gradually up till it occupies the whole of it.

This kind of swelling is at first often mistaken for common œdema or anasarca ; and seems to be so far of this nature, that it is evidently produced by effusion into the cellular substance : But instead of being of the serous kind, the effused fluid is found to be tinged with blood, and of an acrimonious nature ; at least this has been the case in all that I have known opened : And it has likewise happened, that the matter has never been discharged in such quantities as to have much influence on the size of the tumor, the swelling usually remaining of nearly the same bulk after the operation

operation as it was before : Hence no advantage is derived from it ; on the contrary, the operation very commonly does harm., A painful sore is produced ; and it always accelerates the progress of the tumor. Indeed, nothing that I have ever known employed has any effect in retarding it ; so that I consider amputation as the only resource, whenever the tumor has become so large as to give much uneasiness. Whether it will always prove effectual or not, I cannot pretend to say ; but hitherto I have met with no instance of the disease returning where amputation was performed on a sound part of the limb.

Swellings of the aneurifinal kind have also been considered as a cause which, in particular situations, may give rise to amputation. This has originated from the operation for the aneurism having failed in different instances when performed upon the crural artery, and from the amputation of the limb having in similar affections saved the life of the patient.

When an aneurism in the ham, or the thigh, is large, and has been of such long duration as to hurt the texture of the soft parts, as well as to injure the bone, which effused blood is apt to do, it will no doubt be better to amputate the limb than to make any attempt to save it: But in such a case, it is not the aneurism for which amputation is advised, but a morbid state of the parts, induced by the disease being allowed to continue too long before any effectual measure is adopted. In the commencement, and for a considerable time thereafter, of the femoral or poplitean aneurism, I should never advise the amputation of a limb: For different instances are on record of limbs being saved by the operation for the aneurism, even where the artery was injured in the superior part of the thigh: But where such an extensive œdematous swelling is induced all over the under part of a limb, as to leave no room to hope that it could again be restored to use, even allowing the operation for the aneurism to succeed, it will

no doubt be better to amputate immediately than to attempt the operation.

The aneurism to which I allude, is that which proceeds from a dilatation of the artery, and in which the coats of the vessel have burst, so as to produce a considerable effusion of blood into the surrounding cellular substance, probably before any proper assistance is desired. This will seldom happen but with the poorest class of people ; and therefore this disease, in the state we are now speaking of, is chiefly found in hospitals. At first it is always attended with a strong pulsation ; but in its later stages the swelling becomes so large, that the beating of the artery is scarcely, if at all discovered ; by which it is apt to be mistaken for a tumor of a different kind : But for the most part, a due attention to the history of the case from the beginning, will lead to a knowledge of its real nature.

The 10th general cause that I enumerated, by which amputation may become

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necessary,



necessary, is particular distortions of a limb.

Where a limb is in other respects perfectly sound, it will seldom happen that any distortion to which it is liable will be considered as a sufficient reason for this operation: But in the course of much business, cases are sometimes met with in which limbs are so much distorted, and produce so much distress, that patients rather incline to have them removed than submit longer to the inconvenience. When in such circumstances we are not able to remove the distortion by means of a more gentle nature, we are in some cases obliged to comply with the patient's request.

II. Certain states of necrosis may render amputation necessary, as may be seen in Chapter XLIII.

These are the several causes by which the amputation of a limb may be rendered necessary. As they are very various, and as the loss of a member is to every patient an object of much importance, they merit, in every instance, the utmost  
attention

attention from practitioners. Indeed this point of practice, namely, that of fixing with precision those cases in which the amputation of limbs should be advised, with the most suitable periods for the operation in each, is attended with such difficulty, and a surgeon is so apt to be blamed if he proceeds to the operation so long as there is the smallest doubt of its being necessary, that it should be held as a fixed regulation with every practitioner, never to operate but with the advice of some of his brethren in consultation, when this can possibly be obtained. I shall now proceed to describe the method of operating.

## SECTION III.

*General Remarks on the Method of Amputating Limbs.*

**S**URGERY is not perhaps in any part of it brought to greater perfection than in the method of amputating limbs. Before the invention of the tourniquet, this operation was attended with so much hazard, that few surgeons ventured to perform it: Nay, long after the introduction of this instrument, the danger attending it was so great, that more than one half perished of all who had resolution to submit to it.

In the present improved state of the operation, I do not imagine that one death will happen in twenty cases; even  
including

including the general run of hospital practice : And in private practice, where due attention can be more certainly bestowed upon the various circumstances of the operation, the proportion of deaths will be much less.

The circumstances in this operation that more particularly require attention, are, the choice, when this is in our power, of the part at which a limb should be amputated ; the prevention of hemorrhagy during the operation ; the division of the skin, muscles, and bones, in such a manner as to admit of the stump being completely covered ; the tying of the arteries alone, without including the nerve or any of the contiguous parts ; securing the teguments in a proper situation, so as to prevent their retraction after the operation ; and a proper subsequent treatment of the case.

Next to securing the patient from loss of blood, the most material of these is the saving of such a proportion of the soft parts as will cover the stump, so as

to heal the sore as nearly as possible by the first intention : For without this, the wound produced by the removal of a large limb is always extensive ; the cure accordingly proves tedious ; and the discharge so copious, that the patient's health is by this cause alone irreparably injured.

The inconveniencies arising from this were so obvious, that various attempts were made, from time to time, to improve this part of the operation. At first, all that was done in amputating a limb, was to cut the soft parts down to the bone by one stroke of a knife, and afterwards dividing the bone with the saw at the edge of the retracted muscles. It was afterwards proposed by Mr Cheselden to divide the soft parts by a double incision ; to divide the skin and cellular substance with a circular incision ; and then to cut through the muscles at the edge of the retracted skin : By this means the saw was applied higher in the bone, and the stump was better covered both with muscles and skin. Still, however, an extensive sore  
was

was left ; infomuch that in amputating the thigh, a cure was seldom performed in less than three or four months ; often five or six were required ; and after all, the stumps were commonly pyramidal, by the bone projecting beyond the soft parts : It often happened too, that another sore was produced by this part of the bone exfoliating, long after the patient considered himself as perfectly well.

To prevent this Pyramidal or Sugar-loaf Stump, as it is termed, a bandage or circular roller was employed, with a view to support the muscles and teguments, and to prevent their retraction ; and when properly applied from the upper part of the limb downwards, it in some degree answered the purpose, but never with such effect as to prevent the cure from being tedious. In order to shorten it farther, it was proposed by the late Mr Sharpe, in his Treatise on this Operation, to draw the teguments near together by stitches or pieces of tape passed through them, and tied across the stump :

stump: But the pain and inconvenience arising from this was so great, that it never was generally practised; and Mr Sharpe himself at last desisted from it.

It was now thought impossible to improve this method of operating, so as to shorten the cure, and in place of a pyramidal stump, to give the fore a plain surface. In consequence of this, about forty years ago, different surgeons attempted to revive what was termed the flap operation; which had been first practised, upwards of a hundred years ago, by an English surgeon of the name of Loudham. It was done by saving a flap of the muscles and skin, in the manner I shall afterwards describe, laying the flap over the stump, and securing it in this situation with proper bandages till it united to the parts beneath.

As this afforded a thick muscular cushion to the stump as well as a complete covering of sound skin, the highest expectations were formed of it: But the objections to it, which I shall afterwards mention, were so great, that the utmost exertions,

exertions, even of expert surgeons, to render it more perfect, have not been able to introduce it to general use.

This failure again excited the attention of practitioners to the improvement of the common operation of amputation; and their endeavours have not proved unsuccessful. By the present improved method of operating, so much of the teguments are saved as completely covers the stump; by which, in some instances, a cure is obtained by the first intention without the formation of matter: And in all, unless there is something particularly bad in the habit of body, or unless the inflammation unexpectedly runs to a very unusual height, a cure is completed in the course of a few weeks. As I consider the improvement by which these ends are effected as one of the most important in modern practice, I hope to be excused, if I shortly state the share I have had in the introduction of it, before proceeding to describe the operation itself.



In the course of my education, while attending the hospital here, as well as the hospitals of London and Paris, the inconveniencies arising from the want of attention to the saving of skin in different surgical operations, struck me strongly; so that I was resolved to take every proper opportunity in my own practice, or treating this point with particular attention.

From the year 1772, when I settled in business, I laid it down as a maxim, not to be deviated from, to save as much skin and cellular substance in the removal of tumors, whether cancers or others, when the soundness of parts admitted of it, as would completely cover the sores; and in amputating any of the extremities, to save as much of them as would entirely cover the stumps. I first performed amputation in the course of that year; and finding the improvement of saving skin to answer even beyond my expectation, (for the cure of a large stump in an amputation of the thigh was completed in three weeks), I did not fail of putting it afterwards in  
practice

practice both in public and private. The practice was likewise adopted by my friend Mr Hay of this place, and more lately by some other gentlemen in their attendance at the hospital; and ever since that period, Mr Hay, I believe, and I, have invariably adhered to it, some deviations being occasionally introduced in the mode of doing it, with a view of rendering it more perfect; by which the cures have in every instance been greatly shortened. In various cases, large stumps which by the usual method would have required several months, were cured in as many weeks: In a few, as was observed above, the parts united by the first intention; and in all, a plain uniform stump was produced.

After this had been practised for several years, Mr Alanfon of Liverpool, in the year 1779, published some Observations upon Amputation, in which a method of operating is described, which he recommends in the warmest manner, as answering every object to be expected from this operation; and more especially, that of

curing the stumps in a great measure by the first intention.

As Mr Alanfon's mode of operating has of late been very deservedly preferred to every other that was before published, I shall afterwards give an account of it; but in the mean time, I shall describe that which I have long been accustomed to practise, and which, after various trials of every other of which I have yet heard, I still continue to prefer. In the first place, I shall describe the operation as it is performed upon the thigh, and shall afterwards speak of the method of amputating other parts of the extremities.

S E C

## SECTION IV.

*Of Amputating the Thigh.*

**I**N amputating either the thigh or leg, the patient should be placed upon a table of an ordinary height, with the leg properly secured and supported by an assistant sitting before him. The other leg should likewise be supported, at the same time that the arms should be secured by an assistant on each side, to prevent interruptions during the operation.

The flow of blood to the limb should now be stopped by the application of the tourniquet, in the manner I have mentioned in Chapter VII.: And as it is of importance to have the instrument placed as near as possible to the top of the thigh, the cushion placed upon the femoral artery should reach the groin.

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This is necessary when the operation is to be performed on the upper part of the limb; but it may likewise be done with safety where it is to be taken off immediately above the knee: And I may here observe, with respect to the most proper place at which a thigh should be amputated, that no more of it should be taken away than is rendered necessary by the disease; for the more of it that is left, the more useful it proves.

An assistant should now be directed to grasp the upper part of the limb with both hands, and to draw up the skin and cellular substance as far as possible. While the parts are in this state of tension, the operator, standing on the outside of the patient, should divide them with a circular incision down to the muscles: This may in general be done with one stroke of the amputating knife, fig. 3. Plate XCVII.; but in large limbs it is easier done at twice. The assistant continuing to draw the teguments upwards, the cellular substance connecting them to the muscles beneath, should  
be

be divided with the edge of the knife till as much of the skin is separated as the operator thinks will completely cover the stump.

The skin being still drawn tightly upwards, the muscles should be divided close to the edge of it down to the bone, by one perpendicular and continued stroke of the knife, beginning with the upper part of the large muscles on the inside of the thigh, and continuing the incision round through those beneath, and on the outside till it terminates where it commenced. During this part of the operation, some attention is necessary to avoid the edge of the retracted skin; but it may always be done if the operator is upon his guard, for he may with little difficulty have his eye upon the course of the knife from first to last; nor can this part of the operation be done with safety in any other manner. Even where different assistants are employed to protect the skin, it will be apt to be wounded, if the operator does not at every point follow the knife with his eye.

In the usual method of operating, the bone would now be sawn across at the edge of the retracted muscles: But we are more certain of having a good stump, the muscles are previously separated from the bone for the space of an inch; and is easily done by inserting the point of the amputating knife between them, and carrying it freely round from one side of the limb to the other. This being done, the muscles and teguments must be drawn as far as the muscles have been separated from the bone; and it is easily done, either with a bit of slit leather, such as is represented in Plate XCVIII. fig. 4. or with the iron retractors in the same Plate, fig. 2. and 3. The periosteum should now be divided at the place where the saw is to be applied, and it should be done with one turn of the knife; for where much of it is scraped off, very tedious and troublesome exfoliations are apt to ensue: The knife should therefore be carried round the bone directly beneath the retractors. At this place the saw should be applied, and  
will

with long steady strokes the bone should be divided. The saw represented in Plate XCVII. fig. 1., answers much better than the usual form of the instrument with a heavy iron back. In performing this part of the operation, the assistant holding the leg should be directed to support it steadily; for if raised too far, the motion of the saw will be impeded, while the bone will be apt to be splintered if it be not sufficiently raised. Any points or splinters that may be left, should be immediately removed with the nippers, Plate XLIII. fig. 2.

The retractors should now be taken off; and the trunk of the femoral artery being easily seen, should be drawn out with a tenaculum, and a sufficient ligature made upon it before the tourniquet is loosened: But as the muscular branches of this artery cannot be discovered as long as they are compressed, the screw should be immediately untwisted, so that the pressure may be entirely removed. All the clotted blood should be now removed from the stump



with a soft sponge soaked in warm water ; and every artery that can be discovered should be secured with a ligature, care being taken to leave the ends of the threads of a sufficient length to hang over the lips of the wound.

The bloodvessels being all secured, and the surface of the wound cleared of blood, the muscles and teguments should be drawn down till the skin completely covers the stump, and should be retained in this situation by an assistant till a flannel or cotton roller, previously fixed round the body to prevent it from slipping down, is applied in such a manner as to support and fix them : For which purpose the roller should be passed two or three times, nearly in a circular direction, round the top of the thigh ; and should afterwards, with spiral turns, be brought down near to the end of the stump, of such a tightness as to prevent the muscles and skin from retracting, without compressing them so much as to prove painful, or to impede the circulation. Here the roller should be  
fixed

fixed with a common pin, while as much of it is left as will pass two or three times round the stump, for a purpose to be presently mentioned.

The ends of the divided muscles being placed with as much equality as possible over the bone, the edges of the skin must be laid exactly together, so as to form a straight longitudinal line along the centre of the stump. When only one or two arteries have been secured, the ligatures should be left out at the inferior angle of the wound; but when there are several, they should be divided between the two angles, to prevent the parts from suffering by a large extraneous body fixed at any one place.

While an assistant retains the edges of the divided skin in contact, two or three slips of adhesive plaster should be laid across the face of the stump, to preserve them in this situation; and the whole surface of the stump should now be covered with a large pledget of soft lint, spread with saturnine cerate, or the common calamine

cerate of the Dispensatories: Over this there should be placed a soft cushion of fine tow with a compress of old linen. For the purpose of retaining them, as well as with the view of making gentle pressure upon the stump, a slip of linen, of three inches in breadth, should be laid over them; so as to pass directly across, and not from above downwards. On being properly placed, the remaining part of the roller should be employed to fix it, by passing it two or three times round the stump; and the pressure formed by the cross strap may afterwards be increased or diminished, by drawing it with more or less tightness, and fixing it with pins to the circular roller.

In applying the roller, the tourniquet should be removed, and replaced immediately when the stump is dressed. If left loose, it gives no uneasiness; and it enables the attendants to check any hemorrhagy that may take place; a circumstance that merits attention for several days after amputation of any of the extremities.

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The patient should now be carried to bed; but instead of raising the stump to a considerable height with pillows, as is usually done, it should be laid somewhat lower than the rest of the body: For this purpose, the bed should be previously made with a gentle declivity from above downwards, and nothing should be put beneath the stump but fine tow.

To prevent the patient from moving the limb inadvertently, as well as to guard in some measure against the effect of those spasms which often prove troublesome after this operation, I commonly employ two slips of flannel to fix the stump down to the bed. It is easily done, by laying one across near the extremity of the stump, and another near to the root of the thigh. They should be pinned to the circular roller round the limb; and the ends of each of them should be pinned to the bed: Or they may be tied to it with pieces of small tape previously sewed to the bed, or to the mattress, which answers better than a feather-bed for any patient to be long confined.

finer. . . A basket or hooped frame, should now be put over the stump, to protect it from the bed-clothes ; and whether the patient complains much or not, I make it a constant rule to give him an anodyne, by which he remains quiet and easy through the remainder of the day, instead of being restless and distressed, which he is otherwise apt to be.

As hemorrhagies will sometimes happen, even many hours after the operation, the attendant taking charge of the patient should be strictly enjoined to examine the stump frequently with the utmost care; and on any quantity of blood breaking out, to twist the tourniquet sufficiently tight, till assistance is procured. I think it right, however, to observe, that in general it is the fault of the practitioner when this very perplexing occurrence takes place ; for it seldom happens when the arteries are searched for in the time of the operation with that accuracy which the importance of the situation requires. Indeed, hemorrhagies are less frequent after  
this

this method of operating, than when the muscles are left uncovered ; and this is one material advantage that results from it : For however attentive a surgeon may be in securing the arteries, the irritation produced upon an extensive wound, and the spasms that ensue, very frequently terminate in fatal hemorrhagies. Of this I have known several instances ; while no discharge of any importance has ever happened in the method of operating, of which I have thus given a description. I believe too, as I have elsewhere remarked, that some additional security is derived from the use of the tenaculum : For although those who have not been in the habit of using it, are apt to consider it as more uncertain than the needle, yet it is far from being so. I will not say that hemorrhagies will never ensue where the tenaculum is employed ; but it has so happened in the course of my observation, that the needle was used in every case of hemorrhagy that proved fatal.

Where

Where there is only a trivial oozing of blood, we need not be alarmed ; nor will it be necessary to remove the dressings : But whenever the discharge is so considerable as to give cause to suspect that it proceeds from a large artery, nothing but securing it with a ligature can be depended on. This being done, the dressings must be renewed in the same manner as at first.

The only other symptoms that we have reason to dread, during the first three or four days after the operation, are severe spasmodic affections of the muscles, and inflammation and tension of the stump, with the consequent fever which in some degree succeeds to every case of amputation, but which always proves hazardous when it proceeds to a great height.

When the arteries are tied without including the nerves or any part of the contiguous muscles, these spasms seldom become troublesome : But when they take place, if laying the limb in an easy relaxed state does not render them inoderate, we trust chiefly to opiates for their removal.

With

With a view to prevent inflammation, the patient should be confined to as low a regimen as the state of his strength will permit. In weak emaciated habits, this must be managed with much discretion, as the constitution might be materially hurt by a low diet: But where there is much plethora, with tense fibres, together with a strict antiphlogistic regimen, the patient should be bled as soon as quickness and fulness of pulse or other symptoms of fever take place: He should take plentifully of diluent drink; and his bowels should be kept open with any of the cooling neutral salts.

It is proper, however, to observe, that it is only during the first days after the operation that remedies of this kind are in general necessary. When the inflammatory stage is over, evacuations of every kind are to be dreaded; even laxatives are apt to do harm if carried farther than is just necessary for preserving a regular state of the bowels.

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At the end of the second day, whatever the previous symptoms may have been, the stump should be examined. Where a free suppuration is expected, as always happens when the stump is not covered with skin, the parts should not be looked at till the third or fourth day: But here there is no reason for this delay; and the patient is always made more easy and comfortable by the removal of the first dressings. For this purpose, the stump should be gently supported by an assistant, till the last turns of the roller are undone, and till the cross slips, tow, and even the large pledget of ointment next the sore, are removed. In a few cases the parts are found united by the first intention; but for the most part it is otherwise: There is commonly a small quantity of matter over the surface of the stump, chiefly at the inferior angle of the wound; and the parts are red, tense, and painful to the touch, with a small separation or opening between the edges of the divided skin, notwithstanding the plasters employed to retain them. As  
in

in this state the plasters do no service, they should likewise be removed ; and it is easily done when they are thus moistened with matter. The surface of the stump should now be covered with a pledget of the same ointment as at first ; and a cushion of soft tow being laid over it, the cross slips of linen and the circular roller should be again employed ; but with no more pressure than is merely necessary for supporting them.

In this manner the dressings should be renewed daily ; when, by the seventh or eighth day, the inflammation and tension will in general be so far diminished as to admit of the ligatures on the arteries being easily removed ; at least they may now be gently pulled daily, and for the most part they yield on the second or third trial : When allowed to remain longer, they not only prevent the wound from healing, but are apt to be more difficult to remove afterwards.

As long as the roller is preserved clean, it may be allowed to remain ; but as soon  
as

as it becomes sullied with matter, it should be removed and another applied in its place; nor should it be entirely laid aside till the third or fourth week from the operation. After this period, however, it should be removed, as when longer continued it renders the limb smaller than the other.

As soon as the sore is observed to be perfectly clean, with granulations sprouting in different parts of it, as the pain and tension will now be quite removed, we may with safety venture to complete the cure, by drawing the edges of the wound together with adhesive plasters. In this state of the sore no harm ever ensues from it, and it shortens the cure considerably.

By this management, even the largest stumps will for the most part be healed in three or four weeks; often in less. But it must be remarked, that although we may in general depend on this in private practice, where every circumstance that can conduce to the welfare of the patient will meet with attention, and where

where especially we may always obtain a well-ventilated apartment and proper diet ; yet in public hospitals, where these points are not duly attended to, and where the patient often suffers more from the bad air that he breathes, than from the operation itself, our success will not in every case be so great. Instead of the teguments adhering to the parts beneath, large quantities of matter sometimes form between them, which always renders the cure more tedious, and which in some cases cannot be accomplished but by sending the patient to a more free air, and by a more plentiful allowance of wine and other cordials than can in general be obtained in hospitals. But for one instance of this, in the operation that I have described, I may with safety affirm, that twenty occur in the usual mode of conducting it.

When speaking of the time in which stumps may be expected to heal, I think it right to observe, that it should not be our object to heal the parts in the first instance without the formation of matter :

ter : It commonly answers better when done in the more gradual manner I have pointed out. When a stump heals suddenly, and the edges of the divided skin adhere by the first intention, the teguments are apt to be puckered and uneven, and the ligatures of the arteries are removed with difficulty. Of this I have had different cases, when such strong adhesive plasters were employed, as kept the edges of the skin in close contact : But when the common court-plaster is made use of, or any other composition possessed of the same degree of adhesive property, although the teguments will be prevented from separating to any considerable extent, yet they will readily yield to the retraction that usually takes place on the accession of tension and pain. In this manner, a slight separation is usually produced ; by means of which the ligatures are easily taken out ; any matter that may form is readily discharged ; the corners left above and beneath by the teguments being drawn together, are much lessened ; and the stump

is always left smooth and equal: Hence those stumps, which take three weeks or perhaps a month to heal, are usually of a better form than those that heal much sooner.

The advantages attending a speedy cure, and covering the stump with skin, are so great, that they need not be enumerated; but I thought it right to mention the inconveniencies that occur from the union of the divided skin being too quickly connected, either with adhesive plasters, or sutures, which last have in some cases been employed.

It will be readily perceived, that the principal difference between this operation and the usual method of amputating, consists in the saving as much of the muscular substance of the limb as will completely cover the bone, together with as much skin as will cover the whole surface of the stump: But it is proper to remark, that we may err in saving more of each of these parts than is requisite, and that some attention is therefore ne-

cessary to guard against it. In leaving too much muscular substance, we must necessarily shorten the limb too much, by sawing the bone higher than we otherwise would do ; and by saving too much skin, we render the surface of the stump puckered and uneven.

With respect to the quantity of muscular substance that should be saved, I have hitherto found, that the directions given above, in general answer the purpose. By separating the muscles from the bone for the space of an inch, and sawing it at this height above where it is divided in the ordinary method of amputating, the bone will always be sufficiently covered with flesh ; and a very little experience enables us to judge of the quantity of skin that should be saved for covering the stump : But even when more is saved than is necessary for this purpose, a little attention will enable us to prevent inequalities. By an assistant drawing down the teguments, in the manner I have directed, before the roller is applied,

applied, as much of them may be pulled down as is just necessary ; and if they are kept in this situation till the application of the roller is finished, any inconvenience which might have ensued from too great a quantity will be prevented.

It will likewise be observed, that in making the first incision of the teguments, I have not desired a circular piece of tape to be made use of, as is usually done, to serve as a direction for the knife. This deviation from the common practice has been long adopted by some individuals ; but so far as I know, it was first suggested by the late Dr Hunter of London ; and I think it a material improvement of this part of the operation : For besides the saving of time, which is always of importance in that state of anxiety to which a patient is reduced who is placed upon a table for the purpose of losing a limb, it in reality puts it in our power to make the incision with more neatness, more speedily, and with less embarrassment, than when the tape is employ-



ed. Those who have been accustomed to use the tape will at first be of a different opinion ; but whoever lays it aside, will find, that the circular incision may be made with more exactness merely by following the knife with the eye ; and I am certain that it may be done in one-half of the time. When the tape is employed, a good deal of time is lost in endeavouring to keep the knife exactly in a line with the edge of it ; and if not applied with the utmost exactness, it necessarily makes the incision ragged and unequal ; an occurrence I have observed in different instances, even with expert surgeons, while I never perceived any inequality where the tape was not made use of.

It has been objected to the operation that I have described, that being more tedious than the usual method of amputating, it must necessarily create more pain. The difference in this respect, however, is trifling ; for it must be remembered, that the incision of the skin, and this is the most painful part in every operation,  
is

is the same in both. The division of the cellular substance is quickly performed, and little or no pain ensues from it; and the third incision, if we may so term it, or the separation of the muscles from the bone, may be performed in the tenth part of a minute. In different instances, I made use of a scalpel for separating the cellular substance from the muscles beneath, as well as for separating the muscles from the bone; but I now find that both these parts of the operation may be done with the common amputating knife, with equal ease and expedition; and we should avoid multiplying instruments, wherever the intention can be answered equally well, with a smaller number. The knife delineated in Plate XCVII., fig. 3., is the one I now prefer, after trying various forms of it: It is of a middling size, somewhat shorter than the one in common use, and perfectly straight. The curved knife is still used by some practitioners, but no good reason has been assigned for it.

If any surgeon should find it difficult to separate the muscles from the bone with this knife, the instrument recommended by Mr Gooch, and delineated in Plate XCVII., fig. 4., may be employed.

I shall now describe such parts of Mr Alanfon's method of performing this operation as are peculiar to himself; and in order to convey the meaning of the author with exactness, I shall give it in his own words, from the second and last edition of his book, page 51.

“ Apply the tourniquet in the usual way; stand on the outside of the thigh; and let an assistant draw up the skin and muscles, by firmly grasping the limb circularly with both hands. The operator then makes the circular incision as quickly as possible through the skin and membrana adiposa down to the muscles: He next separates the cellular and membranous attachments with the edge of his knife, till as much skin is drawn back as will afterwards, conjointly with the following division of the muscles, cover the  
surface

surface of the wound with the most perfect ease.

“ The assistant still firmly supporting the parts as before, apply the *edge* of your knife upon the inner edge of the musculus vastus internus, and at one stroke cut obliquely through the muscle upwards as to the limb and down to the bone ; or, in other words, cut in such a direction as to lay the bone bare about two or three fingers breadth higher than is usually done by the common perpendicular circular incision : Now draw the knife towards you, so that its point may rest upon the bone, still attending to keep it in the same oblique line, that the muscle may be divided all round the limb in that direction by a proper turn of the knife ; during which its point is kept in contact with, and revolves round, the bone.

“ The part where the bone is to be laid bare, whether two, three, or four fingers breadth higher than the edge of the retracted integuments ; or, in other words, the quantity of muscular substance to be

taken out in making the double incision, must be regulated by considering the length of the limb, and the quantity of skin that has been previously saved by dividing the membranous attachments.

“ The quantity of skin saved, and muscular substance taken out, must be in such an exact proportion to each other, as that, by a removal of both, the whole surface of the wound will afterwards be easily covered, and the length of the limb not more shortened than is necessary to obtain this end. However, it is to be observed, that the more muscular substance we save, by fully giving the oblique direction to the knife, instead of dividing the membranous attachments, the better.”

Mr Alanfon now gives some directions for the use of the retractor ; for securing the divided arteries with ligatures ; and for the application of the flannel roller. Afterwards he proceeds thus :—“ You are now to place the skin and muscles over the bone in such a direction as that the wound shall appear only in a line with the angles

at each side ; from which points the ligatures are to be left out, as their vicinity to either angle directs : The skin is easily secured in this posture by long slips of linen or lint, about two fingers in breadth, spread with cerate or any other ointment : If the skin do not easily meet, it is best brought into contact by slips of linen spread with sticking plaster. These are to be applied from below upwards across the face of the stump, and over them a soft tow pledget and compress of linen, the whole to be retained by the many-tailed bandage, with two tails or slips to come from below upwards, to retain the dressings upon the face of the stump."

Mr Alanson uses a knife with a double edge, which he thinks preferable to the one commonly employed.

As I wish the author's ideas to be clearly understood, I think it right to add, that in p. 17. he directs the bone to be laid bare three or four fingers breadth higher than is usually done by the common perpendicular incision of the muscles ; that  
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is, that by the oblique direction of the knife, three or four fingers breadth of muscular substance should be scooped out. And, in page 21. he observes, "that a stump formed in the thigh, agreeably to the foregoing plan, if you bring the parts gently forwards after the operation, and then view the surface of the wound, may, in some degree, be said to resemble a conical cavity, the apex of which is the extremity of the bone;" and the parts thus divided, he observes, are obviously the best calculated to prevent a sugar-loaf stump.

From what has been said, it will appear, that Mr Alanson's method of operating differs chiefly from that which I have advised above, in the manner of dividing the muscles, and in the after position of the skin. Every surgeon is apt to be partial to that mode of operating which he has been accustomed to practise; but being always anxious to have this very important operation improved to the highest possible degree, I was resolved to give Mr Alanson's method a fair trial, being hopeful,  
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from the accounts received of it, that I should find it answer better even than that of which I have spoken so highly. I can with truth, however, assert, that it did not answer my expectation. The stumps formed by it are, indeed, much better than can be made by the usual method of amputating ; but the removal of such a large portion of muscular substance, as is done by Mr Alanson's oblique incision, produces a hollow, that not only retains the matter, but prevents the stump from being so smooth and equal as when the skin is supported by a flat muscular surface in the manner I have advised. Mr Alanson, who is in the daily practice of it, may be able to obviate these difficulties ; but I know that I cannot make such a good stump in this manner as I always do in the other method of operating ; nor is Mr Alanson's own idea so completely answered by his method of operating. He very properly observes, page 36. that in the thigh we want a sufficient cushion between the bone and machine to be used in walk-



ing ; that the more muscular substance that is saved, the farther will the point of bone on which the pressure principally produces inconvenience, be removed from the surface of the machine ; and likewise, that a more vigorous circulation will be kept up all round the extremity of the bone and stump, which lessens the danger of exfoliation. Now, it is obvious, that the end of the bone will not be so much covered with muscular substance when a considerable portion of the muscles is removed by the oblique incision as when they are allowed to remain ; nor will the circulation be so vigorous round the end of the bone.

But admitting Mr Alanson's method of operating to be in every point equal to the other, the greater difficulty of performing it is a weighty objection against it. Indeed few, I believe, will be able to divide the muscles by the oblique incision without mangling the skin, even with the explanation given by Mr Alanson in the last edition of his book. Accord-  
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ingly we find, in page 204. that this actually happened in the hands of an expert surgeon, Mr Lucas of Leeds, even where the division of the muscles was not begun close under the retracted integuments, but a little lower. Nor will this be an uncommon occurrence, if the muscles are divided with the edge of the knife, as is directed by Mr Alanfon. I have divided them with the point of the knife, but with difficulty; for the point cannot be easily carried round to the height of three or four fingers breadth above the retracted skin, so as to make a smooth equal cut. I do not see how the edge of the knife can be applied to cut so obliquely upwards without hurting the skin; and yet Mr Alanfon's words are, "apply the edge of your knife, and at one stroke cut obliquely through the muscles," &c. He desires, indeed, that the incision may be finished with the point; but I do not understand how it can be done without cutting the skin, if the point be not employed from first to last in the division of the muscles.

muscles. Indeed, Mr Alanfon himself admits that there is difficulty in this part of the operation ; for in page 18. he says, “ that, while one assistant continues a firm and steady elevation of the parts, another should attend to preserve the skin from being wounded as the knife goes through the muscles at the under part of the limb.” This, of itself, appears to be a material objection to this method of operating : For two assistants, whose hands are all employed nearly at one point, must be apt to embarrass not only each other but the operator : And besides, it must often happen, that two assistants cannot be procured.

With respect to the line of direction in which the wound should be closed, Mr Alanfon observes, page 67., if it be formed from above downwards, the cicatrix will generally be found directly opposite to the bone ; by which, in walking with an artificial leg, the point of pressure must be upon the new-formed skin ; which he thinks will be avoided by forming the line in the contrary direction from side

to fide : In which case, after the cure is complete, it will be found, that in consequence of the more powerful action of the flexor muscles, the cicatrix is drawn downwards, and the extremity of the bone is therefore covered with the old skin ; by which the greatest pressure falls upon this part, and not upon the new-formed skin.

I have not found, however, that this argument is of much importance ; for this retraction of the flexor muscles to which Mr Alanson alludes, is in a great measure owing to the custom of elevating the stump after the operation, and may be prevented by keeping it lower than the rest of the body, in the manner I have mentioned. And besides, the bone is so well covered with muscular substance, and the cicatrix so narrow when the operation is rightly done, that I have not met with a single instance of any inconvenience arising from this circumstance mentioned by Mr Alanson : Whereas, the lodgment of matter proves always  
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so troublesome and pernicious, and would in all probability occur so frequently were the practice generally adopted in making a transverse opening instead of longitudinal one upon the face of the stump, that this appears to be a sufficient reason for preferring the former.

With a view to prevent that inequality on the surface of the stump, which arises from the retraction of the flexor muscle of the thigh, I have in some cases divided these muscles an inch lower than those of the rest of the limb. After dividing the skin and cellular substance with a circular incision in the usual way, this is easily done; and it prevents this inconvenience in the most effectual manner: But it is not necessary when the stump is treated in the manner I have mentioned.

Whether others may deem these observations upon Mr Alanson's method of amputating important or not, I cannot determine; but as they appeared to me to be of consequence, I thought it my duty to offer them.

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It is but justice, however, to remark, that the public is much indebted to Mr Alanfon for his assiduity in endeavouring to improve this very important operation, and for the many useful practical remarks contained in his publication.

## SECTION V.

*Of Amputating the Leg.*

**I**N amputating the thigh I have observed, that as much of the limb should be saved as can be done with safety ; for the longer the stump the more utility is derived from it : But in amputating the leg, it has hitherto been a general rule to take it off a little below the knee, even where the disease is seated on or near to the ankle, and where accordingly the operation might be performed much lower. The reason given for this is, that a few inches of the leg being saved, answers as a sufficient rest to the body in walking when the limb is inserted into the box of a wooden leg ; and when much more  
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of it is left, that it proves troublesome both in walking and sitting, without being attended with any particular advantage.

Were we to conclude, that the common practice of bending the joint of the knee and resting upon the anterior part of the leg was necessary, this method of operating a little below the knee would be admitted as the best : But as we have now had many instances of patients walking equally well with machines, so contrived as to admit of the use of the knee-joint ; as these machines, by resembling the human leg, are much more pleasing to the eye than the wooden ones in common use ; and as the operation may be done with much more ease and safety to the patient a little above the ankle, I am of opinion that it should always be done here whenever it is practicable, instead of the ordinary place a little below the knee.

The operation is easier performed a little above the ankle than at the upper



part of the leg, by the parts to be divided being less extensive ; for the diameter of the leg is here considerably less ; and it is done with more safety by our being able to cover the bone more completely with soft parts, so as to accomplish a cure in the same manner and equally soon as in the thigh : Whereas, immediately below the knee, the bones are not only larger, but there is such a scarcity of soft parts, that the cure proves always much more tedious, notwithstanding all our endeavours to promote it ; inasmuch, that in operating at the usual place, about four inches beneath the patella, the fore, with all the attention we can give to it, will seldom heal in less than ten or twelve weeks ; and in the common method of forming the double incision, it will even require four or five months : Whereas, when the operation is rightly performed a few inches above the ankle, a cure may, for the most part, be effected in a fortnight or three weeks.

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It is true that a method of amputating beneath the knee has been proposed, by what is termed the Flap Operation, and by which a cure may be more speedily obtained than in the usual way of operating; but still it is tedious, and at the same time liable to other objections, which I shall have presently occasion to mention. I therefore conclude, that in every case that admits of it, amputating a little above the ankle is preferable to operating immediately below the knee.

We are next to determine the most proper place for the operation, when we are prevented by the extent of the disease in the leg from amputating lower than the usual place beneath the knee. Where the upper part of the leg is found, it has hitherto been a fixed maxim to amputate below the joint of the knee rather than above it.

While practitioners were unacquainted with the present improvements on this operation, they seem to have adopted this maxim, chiefly from finding that

the body rested more easily upon the sound skin on the fore-part of the leg than on the stump of the thigh: But now that the operation, when done above the knee, may be so performed that the fore will heal in less than one half of the time that is required when the leg is taken off immediately below the joint; and in such a manner that the stump is covered with sound skin, as well as with some muscular substance, which admits of the patient resting upon it with freedom; this reason, upon which the practice is chiefly founded, falls to the ground.

I have observed above, that the cure of a stump immediately below the knee is always tedious, owing to the great extent of bone at this place, and the natural deficiency of soft parts.

Upon the whole, therefore, I conclude, that amputation immediately below the knee should seldom or never be advised: But as no innovation will at first be generally admitted, I think it right to describe  
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the method of operating when it is determined to amputate at this part.

The patient should be placed upon a table and secured in the same manner as in operating above the knee. The tourniquet should be applied a little above the knee, with the cushion upon the artery in the ham. The foot and leg should be secured by an assistant sitting before the patient, while the teguments are drawn up by another assistant towards the knee. The surgeon, standing on the inside of the leg, should now with the knife, Plate XCVII. fig. 3. make a circular cut through the skin and cellular substance down to the muscles, so far down upon the limb, that when as much of the teguments are separated from the parts beneath as will cover the stump, the muscles and bones may be divided immediately below the insertion of the flexor tendons of the leg. The interosseous soft parts must be divided either with the point of the amputating knife or with the catline, Plate XCVII. fig. 2. The retrac-

tors, Plate XCVIII. fig. 2. and 3. must now be applied so as to support and protect the skin and other soft parts from the saw employed for dividing the bones. This being done, and the vessels secured in the usual way with ligatures, the teguments should be drawn over the stump and retained with adhesive plasters, in the manner I have advised in amputating the thigh. The practice, indeed, should be the same during the whole course of the cure; only, in the application of the flannel roller, there is no necessity for beginning at the top of the thigh: It should receive, however, two or three turns above the knee, to prevent it from slipping down.

In separating the adhesions of the skin from the parts beneath, as much of the cellular substance should be taken along with it as can be got; otherwise the circulation in the skin itself is apt to become so languid as to prevent it from adhering to the parts on which it is applied. It will be found too, that more  
attention

attention is necessary to destroy the attachments of the skin in this situation, particularly on the fore-part of the leg, than in the thigh, owing to the cellular substance being more condensed where it lies so contiguous to the bone, than in the thigh, where the muscles intervene. And as this state of the cellular membrane prevents the teguments from retracting freely after they are divided; and as they cannot even be pulled sufficiently up by the assistant, it is necessary to fold such of them as are separated from the parts beneath, back upon the sound skin, before the division of the muscles is attempted; otherwise the skin will either be cut with a knife, or the muscles will not be divided so high as they ought to be.

Always at this part of the leg, and in a few cases immediately above the ankle, I have found it necessary to fold the skin back in this manner; but hitherto no instance has occurred in the thigh, where the operation might not have been done  
merely

merely by pulling the teguments up, in the manner I have formerly mentioned.

I have, desired above, that in this operation the surgeon should stand on the inside of the leg: By this, if the knee and foot are turned inwards, so as to raise the fibula, the saw may be applied in such a manner to both bones as to divide them nearly together, the surest method of preventing them from breaking when nearly sawn through: Whereas, on standing on the outside of the patient, the fibula is more apt to be left to the last; at the same time that the saw is applied upon the ridge of the tibia, so as to act upon its longest diameter, by which it is not so quickly divided.

In operating above the ankle, that spot should be fixed upon that will leave the stump of the most convenient length for being fitted with a leather machine resembling the other leg. And I find from observation, as well as from information obtained from Mr Wilson, a late ingenious tradesman of this place, that nine  
inches

inches from the joint of the knee is the best length for this purpose; for it affords a sufficient support to the machine, and at the same time prevents it from being so heavy and clumsy as when the leg is left of a greater length: for when taken off immediately above the ankle, the stump must go down to the very bottom of the machine, which must therefore be thicker and heavier at the ankle than it otherwise might be; at the same time that it will not correspond so exactly as it otherwise would do to the size of the other leg.

In addition to what I have said upon the method of amputating the leg immediately below the knee, I may observe, that, in operating above the ankle, it should be done exactly as I have advised in describing the amputation of the thigh: Only in this situation, instead of muscles, we find a portion of both bones covered merely with skin and cellular substance; but as the cellular membrane is here commonly sufficiently lax, and in greater quantity



quantity than in the upper part of the leg, it is not only more easily separated from the periosteum, but serves to give the bones a more complete covering: By which, when the operation is properly done, the cure for the most part is accomplished in less than three weeks, and the surface of the stump is equal, and every where covered with sound skin.

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## SECTION VI.

*Of Amputating with a Flap.*

**I**N amputating in the usual way, the cure was so extremely tedious; the health of the patient was thereby so much injured; and the stumps, when healed, were so pyramidal, and so thinly covered with soft parts, that another method of operating, as I have observed above, was proposed upwards of a hundred years ago; in which an attempt was made to obviate these difficulties, by preserving a flap of muscle and skin for the purpose of covering the stump.

This was first proposed by one Loudham, a British surgeon: It was afterwards

wards practised in Holland, Germany, Switzerland, and France; and more lately by some individuals in Britain and Ireland: But it has never been received in general use, nor is it probable that it ever be frequently performed.

The chief objections to it were, the difficulty of restraining hemorrhagies when they happened to recur after the flap was applied and fixed in its situation with sutures, for in order to discover the bleeding arteries, it was necessary to undo the whole; the flap not adhering uniformly over the whole surface of the stump; the pain, inflammation, and tension, that supervened to this operation, being much more severe than after the usual method of operating.

To remove these difficulties, it was proposed, about forty years ago, by J. O'Halloran, an ingenious surgeon of Limerick, to dress the stump and flap as separate surfaces for the first twelve days; when the risk of hemorrhagy being over, the symptoms of pain, inflammation, and tension subsided.

subsided, and suppuration established, we are directed to turn the flap back upon the surface of the stump, and by means of plasters, compression, and bandage, to secure it in this situation till they unite.

By this improvement the operation was rendered more safe and certain; and it is probable that it would gradually have come into general practice, if the improved method of operating, that I have already described, had not in the mean time been introduced: But although this will probably continue to be generally preferred, yet in particular situations, the operation with the flap may with much propriety be employed. Wherever the divided parts cannot be properly covered with skin in any other manner, it ought certainly to be done with a flap: And this will always be the case in amputating the arm at the shoulder, and the thigh at the hip-joint, as well as in removing any of the fingers or toes: It may likewise by some be preferred to the method of operating that I have described, when it is resolved to am-  
putate

putate immediately below the knee ; for the teguments being in this part extremely thin, the stump cannot in any other manner be sufficiently covered. But for the reasons that I have given, it can never be necessary, either above the knee ; immediately above the ankle ; nor in the arm or fore-arm. Some, however, may continue to prefer it, even in these parts ; so that it will be proper to describe the method of doing it in all of them ; which I shall therefore do in the following Sections.

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## SECTION VII.

*Of Amputating at the Hip-Joint.*

**T**HE amputation of the thigh at the hip-joint has always been considered as one of the most hazardous operations: It has therefore been very seldom performed. Indeed surgeons in general have spoken of it as one of those operations which authors might describe, but which would never be practised; and when we consider the great size of the blood-vessels which supply these parts: the difficulty of commanding the hemorrhagy during the operation; and the very extensive wound which, in the usual method of operating, must necessarily have ensued here; we will not be surprised at the aversion that has generally prevailed against it.

But if these difficulties can be removed ; if danger from hemorrhagy can be prevented during the operation, as well as afterwards ; if the sore can be so completely covered with skin as to be healed in the course of a few weeks ; and if cases ever occur that would otherwise end in the death of the patient ; we surely would not hesitate to advise it. Now, I hope to make it appear, that the operation may be done with very little loss of blood ; and that as much skin may be saved as will cover the sore entirely : And no practitioner will doubt of diseases taking place at the top of the thigh, which cannot be removed but by amputating the limb.

Having already treated fully of the causes by which amputation of limbs may become necessary, I shall now refer to what was said upon that part of the subject ; and at present I shall only observe, that gun-shot wounds, accompanied with fractures of this part of the bone, spina ventosa, or caries of the head of the femur, will be the most frequent causes of  
amputating

amputating at the joint of the hip. When the operation is to be performed, it may be done in the following manner.

The patient should be placed upon a table ; and it will be found that the parts that are meant to be divided will be brought most clearly into view by laying him on the sound side. In this situation, he should be secured by two or three assistants. while another assistant takes the management of the limb.

Let a small pad or cushion be now placed upon the femoral artery, immediately after it passes out from beneath Poupert's ligament into the thigh ; and, by means of a tourniquet applied as near as possible to the top of the limb, let the circulation be completely stopped. Let the skin, membrana adiposa, and tendinous fascia of the thigh, be divided by a circular incision six inches from the top of the thigh ; that is, at least three inches beneath the circular band of the tourniquet. Let the retracted skin be pulled an inch upwards ; and at the edge of it let



the amputating knife be applied, so as with one perpendicular circular stroke the muscles may be cut down to the bone. If the muscles are freely divided, they will retract so much as to admit of sufficient space for securing not only the femoral artery but all the muscular branches. This being done, take a strong round-edged scalpel, larger than the common size, and commencing at the upper edge of the circular cut on the posterior part of the thigh, make a deep incision down to the bone, and carry it up of the same depth to a little above the great trochanter into the joint. Let a similar cut be made on the opposite side of the limb, at a sufficient distance from the femoral artery, and completely down to the bone. Let the two portions of flesh be now dissected from the bone, and the flaps formed by them be taken care of by assistants, while any artery that may be cut should be tied as soon as it is observed. The joint being laid bare, some dexterity is required to disengage the head of the femur from the acetabulum; for it  
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is rendered difficult by being tied down with the ligamentum rotundum: But by turning the bone in different directions, and particularly by pressing it inwards, where it yields most readily from the brim of the acetabulum being lowest, the head of it may be so far turned out of the socket on the opposite side as to admit of the ligament being reached with the point of a scalpel or a firm probe-pointed bistoury; but to accomplish this, the muscles must all be previously detached from the bone.

The head of the bone being taken out, and the limb removed, we may examine the state of the acetabulum: for if it is found, our prospect of a cure will be more favourable than if any part of it were carious. But in whatever state the bones may be, our treatment of the sore must be the same: We must endeavour to cure it as nearly as possible by the first intention: For which purpose, after removing all the coagulated blood from the surface of the wound; placing the

muscles as nearly as possible in their natural situations ; and drawing the two flaps together, so as to cover the sore as neatly as may be, they should be secured in this situation with three or four sutures introduced at the most proper points ; by adhesive plasters ; and by proper compresses retained with a broad flannel roller passed different times round the body, and spirally over the stump ; care being taken to leave the ligatures upon the arteries of a sufficient length to admit of their being afterwards drawn out.

The patient should now be laid in bed, and treated in other respects as I have advised in general after the Operation of Amputation : Only it must be remarked, that more than ordinary attention is required to prevent and remove such febrile symptoms as usually succeed to amputation ; for where such a considerable part of the body is suddenly taken away, almost a fourth part of the whole, we may reasonably conclude that the effect produced by it upon the system must be considerable.

considerable. If the patient is plethoric, it will be proper to diminish the quantity of blood; in the first place by venæsection, and afterwards by a low diet: Indeed moderate living should be persevered in, if not for life, at least for a great length of time.

The dressings may be removed at the usual time, and in the course of ten or twelve days the ligatures may be all taken away; at which time, any part of the sore that remains open may be covered, by drawing the skin over it, and securing it with adhesive plaster. In such an extensive sore, it is indeed probable that matter may collect in different parts beneath the skin; for the pressure applied upon it, will not be so equal as in common cases of amputation: But the inconvenience arising from this will not be great; for if the matter cannot be discharged by altering the pressure, it will be easily done with the point of a lancet, by which this obstruction to the cure will be removed.

At all times this will necessarily be considered as a very formidable operation; but when performed in the manner I have advised, much of the hazard, and many of the inconveniencies usually supposed to attend it, will be removed: Nor should any practitioner accustomed to operate, hesitate in performing it, when the life of a patient will otherwise be endangered. By the tourniquet, we effectually command the circulation in the limb till all the large bloodvessels divided by the circular incision are tied; and by securing the different arteries that are cut in making the longitudinal incisions as soon as they appear, the loss of blood will be inconsiderable: Nor will there be any risk of hurting the femoral artery in the course of separating the flap in which it is seated from the bone, if it is done with caution.

It may be alleged, that by this method of operating, more of the teguments and muscles will be saved than are necessary for covering the fore; but it must be remembered,

remembered, that the sore will here be very extensive, and that the divided muscles will retract considerably. And besides, the tourniquet could not be applied if the first cut was much higher than I have directed; by which the operation would necessarily be rendered much more dangerous: Nor can any risk ensue from the teguments and muscles being left somewhat longer than might just be necessary, while much inconvenience would arise from their being deficient.

In the sixth volume of the Medical Commentaries of Edinburgh, a case is recorded, in which the thigh was amputated at this joint by Mr Kerr, surgeon in Northampton. In this case, the division of the femoral artery was reserved to the last; nor was the tourniquet employed. No hemorrhagy indeed occurred; but there was surely more risk of this than if the operation had been done in the manner I have advised: Nor could the operator use such freedom with the bone, in removing the head of it from the socket,

as

as long as the bloodvessels remained undivided. I may remark, however, that this case affords an instance of this operation being practised with safety: For although the patient died, yet she lived eighteen days after the operation, and at last died from a different cause, when all risk of hemorrhagy was over, and when the sore had even a favourable appearance.

## SECTION VIII

*Of the Flap Operation immediately above the  
Knee.*

**W**HEN this operation is to be performed above the knee, it may be done either with one or two flaps, but it will commonly succeed best with one. The flap answers best on the fore-part of the thigh; for here there is a sufficiency of soft parts for covering the bone, and the matter passes more freely off than when the flap is formed behind.

The patient being placed upon a table, the tourniquet being applied in the usual way at the top of the thigh, and the teguments drawn firmly up and retained by  
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an assistant, the extent of the intended flap should be marked with ink. A person much accustomed to this operation may not require this assistance; but it will be done with more neatness and accuracy if the form and extent of the flap are previously marked.

The extreme point of the flap should reach to the end of the limb, unless the teguments are in any part diseased; in which case, it must terminate where the disease begins, and its base should be where the bone is to be sawn. This will determine the length of the flap; and we should be directed with respect to the breadth of it by the circumference of the limb: For, the diameter of a circle being somewhat more than a third of its circumference, although a limb may not be exactly circular, yet by attention to this, we may ascertain with sufficient exactness the size of a flap for covering a stump. Thus, a flap of four inches and a quarter in length will reach completely across a stump whose circumference

ference is twelve inches; but as some allowance must be made for the quantity of skin and muscles that may be saved on the opposite side of the limb, by cutting them in the manner I have directed, and drawing them up before sawing the bone; and as it is a point of importance to leave the limb as long as possible, instead of four inches and a quarter, a limb of this size, where the first incision is managed in this manner, will not require a flap longer than three inches and a quarter, and so in proportion according to the size of the limb. The flap at its base should be as broad as the breadth of the limb will permit, and should be continued nearly, although not altogether, of the same breadth to within a little of its termination, where it should be rounded off so as to correspond as exactly as may be with the figure of the fore on the back part of the limb. This being marked out, the surgeon standing on the outside of the limb should push a straight double-edged knife with a sharp point to the depth of the bone,

bone, by entering the point of it at the outside of the base of the intended flap; and carrying the point close to the bone, it must here be pushed through the teguments at the mark on the opposite side. The edge of the knife must now be carried downwards, in such a direction as to form the flap according to the figure marked out; and as it draws towards the end, the edge of it should be somewhat raised from the bone, so as to make the extremity of the flap thinner than the base; by which it will apply with more neatness to the surface of the fore. The flap being supported by an assistant, the teguments and muscles of the other parts of the limb should, by one stroke of the knife, be cut down to the bone about an inch beneath where the bone is to be sawn; and the muscles being separated to this height from the bone with the point of the knife, the soft parts must all be supported with the leather retractors, Plate XCVIII. fig. 4. till the bone is sawn, and any splinters that may be left, are  
cut

cut off. All the arteries that discharge much blood must now be secured in the usual way with the tenaculum, the ligatures being left of a sufficient length for hanging out at the edge of the flap.

The skin and muscles should now be drawn down and secured with a flannel or cotton roller, in the manner I have advised when a leg is amputated with a circular incision; and the flap may now be laid down over the surface of the fore, so as to effect a cure as much as possible by the first intention; or it may be dressed as a separate fore, agreeably to the practice of Mr O'Halloran, according to the judgment of the operator. If the flap is to be applied immediately, the coagulated blood should be carefully sponged out, and it should be secured to the muscles and teguments surrounding the rest of the stump by three or four sutures passed at least three quarters of an inch into the muscular part of it: But care should be taken not to draw

draw the ligatures so tight as to create much irritation or pain. The under part of the stump should now be covered with a large pledget of common cerate; and a cushion of soft tow being laid over it, the whole should be secured in the manner I have formerly advised, with cross straps of linen and a few turns of a circular roller.

In three or four days, the dressings may be renewed; and as soon as the ligatures are all removed, and the tension and inflammation induced by the operation abated, any part of the fore that was not covered at first may now have the skin drawn over it, and secured with adhesive plasters.

But if Mr O'Halloran's method is to be adopted, the easiest mode of proceeding is this. The muscles and teguments being drawn down and secured with the roller, let the whole surface of the stump be covered with a pledget of soft lint spread on both sides with any soft emollient ointment: Let the flap be laid  
down

down upon this ; and another pledget of the same kind being laid over the whole with a cushion of tow and a compress of soft linen, the cross straps and circular roller should be employed to support them, but with gentle pressure. At the end of three or four days, the dressings may be renewed in the same manner ; and about the twelfth or fourteenth day, or whenever the tension induced by the operation is removed, the ligatures being all taken out, and a proper suppuration established, the flap may be brought into contact with the fore beneath with a view to make them unite. For this purpose, any matter that may be observed upon the surface of either of them should be gently removed with a soft sponge ; and the flap being laid down with as much exactness as possible, it may either be secured with adhesive plasters supported by the bandage above mentioned, or two or three sutures may be employed for it. This last method will give more pain than the other ; but this will be amply

compensated by the flap being retained with more accuracy in its situation.

Farther experience must evince which of these methods should be preferred, for as yet it is not determined. It is my own opinion, that the secondary union recommended by Mr O'Halloran is the best : For the pain, tension, and inflammation that ensue from the other, run often so high as to render it necessary to remove the dressings and even the ligatures ; by which much additional trouble is given to the practitioner, and much distress to the patient. Whereas, when the tension and inflammation are gone before the flap is laid down, little or no pain is induced by it ; nor is the cure effected in this manner more tedious : On the contrary, it would appear to be in general accomplished more quickly in this way than in the other. Even where the flap has not been applied to the sore till the fourteenth day, the cure has been completed before the fourth week : Whereas, few, if any, cures, have been effected so early where the flap  
was

was applied immediately after the operation.

In operating with two flaps, the following is perhaps the easiest method: The patient being placed upon a table, and the tourniquet applied, let the skin be drawn up by an assistant, and a circular incision made through the teguments and muscles down to the bone at the inferior part of the limb, with the edge of the knife turned obliquely upwards: Let the sharp-pointed knife, mentioned above, be now pushed through the skin and muscles on one side of the limb down to the bone, at that part where it is to be sawn; and the under edge of the knife being turned obliquely outwards, let the muscles be divided down to the circular incision. The teguments and muscles on the opposite side of the limb must now be divided by a similar incision, when any of the intermediate soft parts that may have been left must likewise be cut; and the bone being sawn, and the vessels secured

X 2

with



with ligatures, the cure may either be attempted by laying the flaps together immediately, or they may be kept separate twelve or fourteen days, and treated afterwards in the manner I have advised above

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## SECTION IX.

*Of the Flap Operation below the Knee.*

**I**N speaking of this operation below the knee, it is not necessary to describe all the steps of it. The views of the operator are the same here as in operating above the knee, and the method of effecting them is nearly similar. After the previous steps of the operation are taken, the size and form of a flap sufficient to cover a considerable part of the fore must be marked out with ink, and this must be separated from the parts beneath in the manner I have already advised: The rest of the soft parts must now be divided, taking care to save as much of the teguments on the side of the limb opposite to the flap as with the flap itself

itself will nearly or entirely cover the fore ; and the cure must afterwards be conducted, either by applying the flap immediately, or after the symptoms of pain, tension and inflammation induced by the operation are gone, and treated in the manner advised in the last section.

It must be observed, however, in operating beneath the knee, that the flap cannot be formed on the fore-part of the limb as is done in the thigh ; for on this part of the leg there is no muscular substance ; and for this reason, we are advised by authors to form the flap on the back-part of the leg. But this is liable to one very important objection, the difficulty of preventing matter from lodging between the flap and the fore after they are brought in contact ; for it must be remarked, that it is moderate pressure only that we dare venture to apply to the flap ; so that it is scarcely possible to prevent the matter from collecting where it does not find a free vent below.

Instead

Instead of forming the flap from the muscles of the back part of the leg, it may be done with more property upon the outside of the limb, where there is a sufficient quantity of muscular substance for this purpose. The point of the knife should be entered on the outside of the ridge of the tibia at the part where the bone is to be sawn; and being carried backwards in a direct line, and at a proper depth to the opposite side of the base of the flap, the edge of it must afterwards be carried down the line previously marked with ink as a direction for the form and length of it.

In this manner the bones may be covered with a flap sufficiently thick, while the matter that forms in the progress of the cure, finding a ready outlet by the inferior edge of the flap, will not readily lodge. In operating immediately above the ankle, we are under the necessity of leaving a flap behind, for there is not a sufficiency of soft parts to admit of it in any other part. But I have elsewhere observed, that the leg should never be taken off

so immediately above the ankle, as it leaves the stump too long for a machine to be rightly fitted to it for walking: But at nine inches from the condyles of the femur, which in an adult is the most proper length for this purpose, the flap may with propriety be formed, in the manner I have mentioned, on the outside of the leg.

S E C

## SECTION X.

*Of Amputating the Foot, Toes, and Fingers.*

**W**HEN the whole foot is diseased, it becomes necessary to take off the limb at the part I have mentioned above the ankle; nay, this should be done even where the parts about the joint are sound, if all the rest of the foot is diseased: For although some have advised the foot to be amputated at the joint of the ankle, yet the practice should not be adopted, as the fore cannot be properly covered, nor is the stump when of this length so useful: But when a considerable part of the foot remains sound, it ought undoubtedly to be saved, and the diseased part of it only removed. I have seen a whole foot taken off, where two of the metatarsal bones only

ly were diseased : While, on the contrary, it should be held as a fixed rule, to remove the diseased parts alone, even where two of these bones only remain sound ; for with the assistance of a shoe properly stuffed, and a firm unyielding sole, even a very small part of the foot proves useful in walking ; especially when the bones on the inside of the foot, or those corresponding to the great toe, and those next to it, are left.

• When the middle part only of the foot is diseased, the metatarsal bones on each side remaining sound, these should be left, and the diseased part only taken out. In this case, the bones should be taken out at the joint, whether they are diseased through their whole length or not ; for although instruments might be invented for cutting even a single bone across in the centre of the foot, the operation would necessarily be much more tedious, and more painful, than the removal of the bone at the joint, at the same time that little or no advantage would be derived from saving a small portion

tion at the end of it. But where one, two or three of the bones on either side of the foot are only partially diseased, as in this case it becomes an object to save as much of the foot as possible, the operation should be so conducted that the bones may be sawn across nearly at the termination of the diseased parts.

In every case of amputation, it is an object of importance to save as much skin as will cover the fore ; especially in amputating any part of the foot where the effect of friction is much to be dreaded in walking. In making the incision, therefore, at that part of the bone where the saw is to be applied, it should be done in such a manner, that a flap may be saved of a sufficient size for covering the fore. With proper attention this may always be done, nor is it often difficult : for the flap may be formed either above or below, or on one side of the toe, according as the teguments are sound or otherwise. But it is proper to remark, that where the skin is sound, it answers best to save it below, for in this  
situation



situation it is firmer, and therefore more able to resist the effects of pressure.

This operation is most easily performed when the patient is placed upon a table. The tourniquet should be applied above the knee, with a compress placed upon the artery in the ham: the limb should be firmly secured by assistants; and on sawing the bone, a piece of pasteboard, or thin splint of timber, should be inserted between it and the contiguous sound bone, to protect the latter from the teeth of the instrument.

The diseased parts being removed, and the divided arteries secured, the flap should be applied as exactly as possible to the fore, and retained with slips of adhesive plaster and gentle pressure with a flannel roller. If sutures are employed, they should be inserted in such a manner as to avoid the flexor and extensor tendons of the toes and foot.

In amputating the toes and fingers, the operation was formerly done by one stroke with a chisel and mallet; but this is liable  
to

to many objections, and has been long in disuse. In general, fingers and toes are amputated in the same manner with the larger extremities, either by preserving a flap sufficient for covering the sore, and afterwards dividing the bone with a small spring-saw, represented in Plate XCVIII., fig. 1., or by the double incision, performed in the manner I have advised in Section IV. of this Chapter. But instead of this, it has for several years been the practice of some individuals, to amputate fingers and toes at the joints ; and whoever will give it a fair trial, will readily prefer it. The patient being placed upon a table, and the limb properly secured, a flap should be marked with ink of a sufficient size for covering the sore. This being dissected from the bone with a scalpel, and supported by an assistant, a circular incision is then made through the rest of the soft parts a little below the joint, and on a line with the base of the flap. The lateral ligament is now to be cut ; and in order to determine the point at which this should

should be done, an assistant should be directed to move the finger. This ligament being divided, the bones are easily dislocated, when the remainder of the operation may be quickly finished. If an artery is to be tied, it should be done with the tenaculum. The flap must be applied to the fore, and secured as neatly as possible with adhesive plasters, and moderate pressure with a flannel roller.

The only objection that has been made to this practice is, the supposed uncertain union of the contiguous soft parts with cartilage. But we now know, that there is no cause for this apprehension, and that a flap will unite as readily with cartilage as with bone, at least I have uniformly observed this to be the case; and we find from Mr Alanson's publication, that the practice has proved very successful in the course of his experience.

## SECTION XI.

### *Of Amputating the Arm at the Joint of the Shoulder.*

**T**HIS operation having always been considered as hazardous and difficult to perform, it has not frequently been attempted: But although it should never be advised when our purpose can be accomplished by amputating lower, yet no practitioner of modern times will decline it, when the life of a patient cannot in any other manner be saved. Abscesses in the joint, caries of the humerus reaching to the joint, compound fractures extending to the head of the bone, gunshot wounds and mortification, may render amputation of the arm at the shoulder necessary.

The operation may be performed with safety by any surgeon of steadiness and  
experience,

experience, and who is possessed of an accurate knowledge of the anatomy of the joint and contiguous parts.

It may be done in different ways ; but the following I believe to be the best.

The patient should be placed upon a table of a convenient height, covered with a mattress and blanket ; and he should be laid upon his back, and properly secured by assistants, as near as possible to one side of the table.

The next object is to guard against hemorrhagy : For this purpose the tourniquet might be placed upon the upper part of the limb, in a manner similar to what I have proposed in amputating at the hip-joint. But here it is unnecessary, as the blood may be completely stopped in its flow to the arm, by compressing the subclavian artery as it passes over the first rib : For this purpose, an assistant should be properly placed with a firm cushion or compress applied upon the course of this artery directly above the clavicle, who with his finger should make such a degree

degree of pressure as may be required : It will readily be known whether it answers or not, by its influence on the pulse at the wrist.

The circulation being stopped, the diseased shoulder should be made to project somewhat over the side of the table ; and the arm being stretched out and supported by an assistant at nearly a right angle with the body, a circular cut should be made through the skin and cellular substance just at the insertion of the deltoid muscle into the humerus. The teguments may be allowed to retract about half an inch ; and at the edge of the retracted skin, the knife may be applied so as to divide the muscles with a perpendicular circular cut down to the bone. Thus far we proceed with the common amputating knife ; but the remainder of the operation should be finished with a scalpel. With a firm round-edged scalpel a perpendicular incision should now be made down to the bone, commencing at the acromion, about half-way between the centre of the deltoid muscle and the in-

ner edge of it, and terminating in the circular incision about an inch above or rather on the outside of the brachial artery. This being done, a similar cut must be made on the back-part of the arm, commencing at the same height with the other, and ending in the circular incision. This should be at such a distance from the first, that the two flaps formed by them both may be nearly of an equal breadth. The brachial artery should be tied as soon as it is cut by the circular incision through the muscles; and any anastomosing muscular branches of arteries that may be cut on the upper and back part of the joint, should be tied immediately on being observed. The two flaps should now be separated from the bone, care being taken to avoid the large artery in dissecting off that part of the flap with which it is connected. An assistant must support the flaps so as to bring the capsular ligament of the joint into view; when an opening being made into it, the head of the bone will be easily dislocated by drawing the arm backward;

ward ; and this being done, the operation will be easily finished, by dividing the remaining part of the ligament.

Any arteries that may have been cut about the joint being tied, the ligatures hanging out at the most depending part of the wound, and the parts cleared of coagulated blood, the two flaps should be laid together so as to cover the joint as neatly as possible, and retained in their situation with two or more sutures. A pledget of lint spread with any emollient ointment should now be laid over the joint ; and a soft cushion of tow or lint, with a compress of old linen, being applied over the whole, a flannel roller should be employed to make moderate pressure upon the joint ; by which the flaps will be kept in contact with the parts beneath, which will not only facilitate their union, but will be the most effectual method of preventing the lodgment of matter.

In other respects, the patient should be treated as I have advised in the preceding Sections when speaking of Amputa-



tion in the Lower Extremities. With a view to prevent any risk from hemorrhagy after the operation, an assistant of experience should sit with the patient for the first two or three days, with directions to apply pressure above the clavicle in the event of any considerable quantity of blood being discharged, till the bleeding vessel can be secured with a ligature. In the course of eight or ten days, the ligatures upon the arteries will come easily away. If matter collects beneath any part of the skin, it must be discharged ; and if the patient is healthy, and no untoward circumstance happens, a cure may soon be expected.

Till of late, it was the practice in this operation to tie the brachial artery and veins with a ligature before proceeding farther. This gave much unnecessary pain, at the same time that it did not render the patient more secure. In the way I have mentioned, the operation may be performed with no risk from the hemorrhagy ; and by tying the artery at the extremity of the flap, several muscular branches

branches will be saved that would be destroyed by tying it near the axilla.

Mr Bromfield, in the first volume of his *Observations and Cases*, has given the best account yet published of this operation. The principal difference between his method of doing it and the one that I have described, consists in the latter being more simple, and therefore more easily performed. By dividing the muscles down to the bone with a circular incision, the operation is more speedily done than by cutting first one muscle and then another, in the manner mentioned by Mr Bromfield. And as the attachments of the latissimus dorsi, the deltoid and pectoral muscles, are removed by the arm being taken away, there is no necessity for proceeding with slowness and caution in dividing them; nor is it necessary to employ two ligatures upon the brachial artery, one considerably higher than the other, as is advised by that author; one ligature applied in the usual way with the tenaculum is quite sufficient, if it is done with

care and attention. And Mr Alanfon very properly observes, in speaking of this operation, that there is no necessity for scraping off the cartilage from the acetabulum of the joint, as is recommended by Mr Bromfield; for it is found, by experience, as I have observed in the last Section, that the teguments adhere to cartilages as readily as to bone.

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## SECTION XII.

### *Of Amputating the Arm.*

**T**HE general observations I have made upon the method of amputating the thigh and leg, apply equally to the amputation of the arm and fore-arm. At present, therefore, I shall only observe, that in amputating the arm, no more of it should be removed than is diseased; for the longer the stump is, the more useful it proves; and the same attention should be given to the saving of teguments for covering the sore that I have advised in amputating the leg. But it is proper to remark, that this may always be done both in the arm and fore-arm without the assistance of a flap: For there is in every part of both a sufficiency of muscles and cellular substance, for admitting of the sore being

ing completely covered by amputating with the double incision, in the manner I have pointed out for this operation upon the thigh; and wherever this can be done, should be preferred to the method of operating with a flap.

C H A.

CHAPTER XLV.

*Of removing the Ends of BONES in Diseases  
of the JOINTS.*

THE amputation of limbs is more frequently advised for diseases of the joints than for any other cause ; and as this often happens where the rest of the limb is sound, it were to be wished, that with safety and propriety we could remove such parts as are diseased, and leave those that are sound. In compound fractures and dislocations, the ends of large bones have frequently been sawn off, when such parts of them have protruded as could not be replaced. The deficiency thus produced, has in most instances been supplied

supplied by nature ; and thus the limbs have remained almost equally useful as before. In a few cases, too, of diseased joints, a cure has been obtained by the head of a bone being sawn off. Among other instances of this to be met with in books, a remarkable one is recorded by a very ingenious and expert surgeon, Mr White of Manchester, who preserved an arm by sawing off the head of a diseased humerus \*. But Mr Park of Liverpool, was the first who ventured to propose it as a general remedy in affections of the joints †. Whether or not it will stand the test of experience, farther trials must determine ; but in the mean time, the public are much indebted to Mr Park for the pains he has taken to introduce a less formidable remedy in place of amputation.

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\* *Vide* Cases in Surgery with Remarks, Part I. by Charles White, F. R. S. &c.

† *Vide* An Account of a New Method of Treating Diseases of the Joints of the Knee and Elbow, by H. Park.

What Mr Park proposes is, that instead of amputating a limb for any external violence done to a joint, for a white swelling, a caries, or any other affection, that the diseased ends of the bones should be sawn off; when nature, he thinks, will commonly supply the deficiency of bone; by which the limb will be preserved, and will prove more useful than any machine that artists can invent.

Mr Park supposes that this operation will be chiefly applicable to affections of the knee and elbow, and more particularly to those of the latter; and he relates a case of white swelling of the knee in which it was practised with success: The under extremity of the femur and the upper end of the tibia were sawn off; no artery of importance was injured; and the vacancy produced by the removal of the ends of the bones was supplied with callus: In the course of ten weeks, a cure of the sore was obtained; the limb became so firm that the man has since been



able to go to sea as a sailor, and he does not even use a crutch.

This, however, is the most favourable view of the proposal; and it is proper to remark, that in the course of the cure, much perplexity occurred from various circumstances; particularly from the difficulty of preserving the limb in a steady fixed situation; from the great depth of the wound; from the lodgment of matter; and from the formation of sinuses. By much attention on the part of Mr Park, all these difficulties were surmounted; but although the merits of the operation must be determined by farther trials, yet the risk attending it appears to be so great, that there is much reason to think that it will never be generally practised.

For a more particular detail of the method of doing it, and of the after-treatment of the sore, the publication itself must be consulted; but for the advantage of those who may not easily meet with it, the following short account of the operation

operation is inserted in Mr Park's own words.

“ An incision was made, beginning about two inches above the upper end of the patella, and continued about as far below its under extremity: Another, crossing this at right angles, immediately above the patella, the leg being in an extended state, was made through the tendons of the extensor muscles down to the bone, and nearly half round the limb; and the lower angles formed by these incisions were raised so as to lay bare the capsular ligament: The patella was then taken out, and the upper angles were raised, so as fairly to denude the head of the femur, and to enable me to pass a small catling across the posterior flat part of the bone immediately above the condyles, taking care to keep one of the flat sides of the point of the instrument quite close to the bone all the way. The catling being withdrawn, an elastic spatula was introduced in its place, to guard the soft parts while the femur was

was sawing through: Which done, the head of the bone thus separated was carefully dissected out: the head of the tibia was then with ease turned out and sawn off, and as much as possible of the capsular ligament dissected away, leaving only the posterior part covering the vessels; which, on examining, I had the satisfaction to find had not only escaped unhurt, but that it was not a very narrow escape: They had still a pretty good covering, and had been, through the whole operation, far enough out of the course of the knife. It must be confessed, that the appearance of the wound was somewhat formidable, exhibiting a very large cavern with very thin parietes; and in short, there seemed little wanting to complete the amputation: Yet as the limb below would not be deprived of any part of its nourishment, and as every healthy incised surface, as well of bone as of soft parts, has a natural tendency to granulate, I could not see any room to doubt, that nature would be able to repair the breach."

Mr

Mr Park afterwards informs us, that he attempted to perform the operation without making the transverse incision: But he found it could not be done; and after spending some time in the attempt, it was thought advisable to desist from it. More than two inches of the femur, and rather more than one inch of the tibia, were removed; which were but just enough to admit of the leg being brought into a right line with the thigh, the previous contraction of the flexor muscles being such as to keep the two sawn ends of bone in close contact: This produced a considerable redundance of the teguments. To support this, that it might not fall inward, and to keep the edges of the incision in apposition till they should acquire some degree of firmness, a few stitches were passed through the skin; not merely along the course of the transverse incision, but upon that part of the longitudinal cut that extended up the thigh. The lightest superficial dressings only were applied, and the limb placed in a case of tin from  
the

the ankle to the insertion of the glutæus muscle.

Mr Park very candidly enumerates several objections that may be made to this operation ; but, at the same time, he thinks that all of them may be obviated. There are two, however, which, in my opinion, will always appear with force against it. The first is, that where the bones of large joints are so much diseased as to render it necessary to remove them, the surrounding soft parts are commonly so much thickened, inflamed or ulcerated, as to render any attempt to save them very uncertain, and much more hazardous than the amputation of the limb : And the second is, the high degree of inflammation that commonly succeeds to wounds of the larger joints.

With respect to the first of these, Mr Park himself wishes it to be understood, that it is chiefly in affections of the joints produced by external violence, that he thinks this operation will be peculiarly useful ; and with respect to the last, he observes, that the heads of large bones have  
been

been frequently sawn off, without any violent symptom taking place: And as he supposes this to be owing to the very free division of the capsular ligaments, which in such cases must always happen, he thinks that the total removal of this ligament, which he advises in this operation, will in a great measure prevent it. I have observed above, that experience alone can determine upon the merits of this operation; but I cannot avoid remarking, that no necessity appears for the removal of any part of the capsular ligament. It may be highly proper to make the opening into it free and large; but to remove it, by dissecting it off from the contiguous parts, must probably add to the risk of the operation, by rendering the inflammation more severe than it otherwise might be; at the same time that it must necessarily render it much more painful as well as more tedious. Farther experience may, perhaps, set this in a different point of view: But at present I see no more reason for removing any part of the capsular li-

gament in this operation, than for the removal of the tunica vaginalis testis in the operation for the hydrocele; a practice now altogether laid aside, even where the cyst is much thickened,

CHAP

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## CHAPTER XLVI.

### *Of Issues.*

**I**SSUES are small artificial ulcers that we form in different parts of the body, for the purpose of procuring a discharge of purulent matter.

As I have elsewhere treated fully of the advantages that may be derived from issues, and of the manner in which they seem to act in the cure of diseases, it is not at present necessary to enter minutely upon this part of the subject: I shall, therefore, only observe, in general, that I am daily more and more convinced of the utility of issues in the cure of long continued sores, of whatever kind they may  
Z 2 be;



be; and that I am still of the opinion that they act solely by discharging a certain quantity of the serous parts of the blood; and not that they serve merely as drains for noxious humours, which, till of late, has been the prevailing opinion of practitioners \*.

Among other errors in practice to which this opinion gave rise, the choice of situation for issues was none of the least remarkable. As it was imagined that ulcers as well as other local diseases were produced by a determination of morbid humour to a particular spot, when issues were advised, it was considered as necessary to place them as contiguous to the affected part as possible, and always on the superior part of the limb when the disease was seated on any of the extremities, in order to prevent the morbid matter from falling down to it. But as we now conclude that issues prove useful or otherwise merely by the quantity of matter which they

\* See Chapter IV. on the Theory and Management of Ulcers, where this subject is fully considered.

they afford, it appears to be of little importance where they are placed; and accordingly they may be inserted wherever the patient thinks they will occasion the least inconvenience.

Some general rules, however, should be observed in the introduction of issues: They should never be placed immediately above a bone thinly covered,—nor directly above a tendon,—nor very contiguous to a large bloodvessel or nerve,—nor upon the belly of a muscle. The best situation for issues is that space which lies between the tendons on the back part of the neck, where there is a considerable depth of cellular substance,—the middle of the humerus, near to the insertion of the deltoid muscle,—and a considerable hollow above the flexor tendon on the inside of each knee. They may likewise be inserted between two of the ribs, and on each side of the vertebræ of the back; or, in short, wherever there is a sufficient quantity of cellular substance for the protection of the parts beneath. It is proper, however, to

remark, that the spot usually fixed upon for issues is perhaps the most improper of any, I mean directly below the knee; where there is never much cellular substance; where the veins of the leg can scarcely be avoided; and where the peas are apt to hurt the contiguous tendons.

Issues may be formed in various ways: By corroding or removing the skin with epispastic applications;—by making an incision with a scalpel or lancet;—by the application of caustic;—and the introduction of a cord.

When an issue is to be opened by removing a portion of skin, a blister must be applied upon the spot, exactly of the size of the intended fore; and on the blister being removed, a discharge of matter may be kept up, by dressing the part daily with any common ointment in which there is mixed a small proportion of cantharides in fine powder: Or, it sometimes proves sufficient to use this irritating application, and a mild ointment of wax and oil alternately.

In

In forming an issue by incision, or with caustic, an opening must be made of such a size as is sufficient for affording a proper quantity of matter ; and the aperture must be preserved by inserting daily into it some extraneous body covered with any mild digestive ointment, such as basilicon or linimentum Arcæi, while the whole must be secured with a proper bandage. Peas are commonly employed for this purpose. Kidney-beans answer very well ; and some make use of gentian root, and of aurantia Curaflaventia, usually termed Orange Peas, turned into a proper form. When the opening is made by an incision, the skin should be supported on one side by an assistant, and on the other by the left hand of the surgeon ; who should now, with a scalpel in the other, make a cut of a sufficient length and depth for receiving the number of peas intended to be put into it, and thus the operation is finished : But when done with caustic, more attention is requisite. Many compositions of caustic paste have been recommended ; but

I have met with none that for this purpose answers so well as the lapis infernalis or causticum commune of different Dispensatories. It should be first reduced to powder, and made into a paste with water, or with soft soap, when as much of it should be applied upon the spot where the issue is wanted as will make an opening of a proper size; but as it is apt to spread to the contiguous parts, some care is required to prevent it. For this purpose, a piece of leather spread with Burgundy pitch, or any adhesive plaster, with a small hole cut in the centre, should be placed upon the part, with the hole directly on the spot where the caustic is meant to be applied. The small spot thus left uncovered, must now be spread with the caustic paste; and over the whole there should be laid another piece of leather spread with the same adhesive plaster, so that no part of the caustic may escape. In the course of ten or twelve hours, the whole may be removed; for before this if the caustic is good, it will have produced an eschar of a sufficient

cient depth. In the space of three or four days, the eschar will separate from the contiguous sound parts, when the opening formed by it must be filled with peas or some other of the substances I have mentioned.

When it is necessary to discharge a large quantity of matter by an issue, and especially when we wish to have it from deep-seated parts, we do it by the introduction of a cord of cotton or silk, forming what is commonly termed a Seton. This we often employ with advantage in deep-seated pains, particularly in pains of the breast and sides in phthisis pulmonalis. In such cases it is commonly inserted between two of the ribs; and it answers better in the direction of the ribs than when placed across them, as is sometimes done. A cord is also a frequent remedy in diseases of the head, particularly in ophthalmia and other affections of the eyes; and in such cases it is usually placed in the back part of the neck

In

In the introduction of a cord, the parts at which it is to enter and pass out, should be previously marked with ink ; and the cotton or silk being put into the eye of the flat needle, Plate LIV. fig. 5. and the parts supported by an assistant, the needle should now be pushed in at one of the spots and carried out at the other, along with two or three inches of the cord, which should be left hanging out. The irritation which the cord excites is soon followed by a plentiful discharge of matter, which may be increased or diminished at pleasure, by covering the cord daily, before it is drawn, with a mild or an irritating ointment.

In former times, it was a frequent practice to form issues by burning the parts into which they were to be introduced with the actual cautery ; and in some parts of Europe it is still continued : But as it is much more terrifying than any of those that I have mentioned, and as it does ~~not~~ appear to be attended with any particular

cular advantage, it is now in general laid aside.

In China, Japan, and some other eastern countries, it is still a prevailing practice, in deep-seated pains, to burn the parts affected down to the bone with moxa. Moxa is a light, soft, combustible down, of a particular plant. A small cone of it being wrapped up, the base of the cone is fixed upon the part with glue or mucilage; and fire being put to the opposite end of it, it is allowed to remain till the whole is consumed; and if one application does not prove sufficient, it is repeated once and again as long as it is necessary. The operation may be done equally well with fine flax; but although it has been sometimes done in different parts of Europe, it will not probably be ever generally practised. I have known it, however, remove the most obstinate sciatic pains, where every other remedy had failed.



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## CHAPTER XLVII.

### *Of the Inoculation of the SMALLPOX.*

**T**HERE is cause to imagine, that almost all eruptive diseases, as well as some others, may be communicated by inoculation : The practice, however, is confined to such as are not apt to return ; for no advantage would arise from inducing diseases to which the system might afterwards be liable. The plague has been communicated by inoculation ; but in this country the smallpox, and of late the cow-pox, are the only diseases that we are accustomed to inoculate. Some trials have indeed been made for inoculating the measles ; but as yet they have not succeeded.

From

From the result of some experiments, there is reason to think, that no disease can be communicated by inoculating with the blood of an infected person. This, however, is not as yet precisely determined; so that farther trials will be necessary to ascertain it. In inoculating the smallpox and cow-pox, we employ the matter contained in the pustules.

The proper period for inoculating,—the preparation of the patient,—and the subsequent treatment of the disease, are points that more particularly fall to the consideration of the physician. The mode of communicating the infection is our only subject at present.

In the more early practice of inoculation, it was customary to tie an infected thread round the arm or leg; to rub a little variolous matter upon any part of the body; or to insert a piece of thread soaked in matter beneath the cuticle, with a small needle, and to allow it to remain till there was reason to think that the infection had taken place. In any of these ways

ways the disease may be communicated: But, as by some of them there is cause to suspect that a variolous atmosphere may be produced, and that the disease may be thus induced in the same way as in the case of a common contagion, and consequently that some of the advantages of inoculation may not be obtained from them, these modes of giving the small-pox ought therefore to be laid aside.

Till of late, inoculation was commonly performed by making an incision of about half an inch in length through the skin to the depth of the cellular substance: A bit of thread impregnated with variolous matter was then inserted, and retained for two or three days with a compress and bandage. To this practice, however, the great unnecessary pain attending it, and the aptness of the wound to degenerate into a disagreeable ulcer, are strong objections.

The present mode of inserting the matter appears to be in every respect more eligible. The point of a lancet, previously covered

covered with variolous or vaccine matter, is insinuated through the cuticle so as to scratch or slightly injure the cutis vera. It might frequently indeed be sufficient to pass it through the cuticle only; but we do not so readily fail when a small particle of blood follows the lancet. When the matter is recently taken in an early period of the disease, the lancet may be introduced without being moistened; but whenever the matter has become firm and hard, it should be rendered soft with a drop of warm water, or by holding it in warm steam.

The operation may be done in any part of the body; but the arm is generally preferred. One scratch would for the most part prove sufficient; but with a view to ensure success, two or even three are commonly made at the distance of an inch from each other. It is to be observed, however, that when the matter takes effect in all the scratches, the inflammation that ensues being communicated from one to the other, is often considerable,

siderable, and gives much pain and uneasiness. This is easily prevented by making only one scratch in each arm, which for several years past I have uniformly done.

In this method of inoculating, we never employ either bandage or compress; for the wound is so trifling that no kind of dressing is necessary: So that we readily see, at the end of a few days, whether the infection will take place or not; for in general, by the third or fourth day, if the operation is to succeed, the scratches made with the lancet become red, swelled, and somewhat painful.

## CHAPTER XLVIII.

### *Of Preventing or Diminishing PAIN in* CHIRURGICAL OPERATIONS.

[O be able to alleviate the misery of those who are obliged to submit to dangerous operations, must afford the highest gratification to every practitioner: and as pain is the most dreadful part of every operation, it necessarily demands our most serious attention.

The pain induced by operations may be lessened in different ways: By diminishing the sensibility of the system; and by compressing the nerves that supply the

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parts upon which the operation is to be performed.

Narcotics of every kind might be employed for the purpose of lessening general sensibility ; but nothing answers this with such certainty and effect as opium.

But as opiates, when given in doses large enough for this purpose, are apt to induce sickness and vomiting, I seldom venture on giving them before an operation, unless the patient has previously been in the habit of using them. In general they prove most useful when given immediately after, when they very commonly alleviate that pungent soreness of which patients at this time usually complain ; and by continuing to give them in adequate doses from time to time, we are often enabled to keep the patient easy, till relief is obtained by the formation of matter, or by the removal of that inflammatory tension that usually takes place after every capital operation: And as this proves not only highly comfortable

fortable to the patient, but tends in the most effectual manner to moderate the febrile symptoms that commonly occur, it should never be omitted.

It has long been known, that the sensibility of any part may not only be lessened, but even altogether suspended, by compressing the nerves that supply it: And accordingly, in amputating limbs, patients frequently desire the tourniquet to be firmly screwed, from finding that it tends to diminish the pain of the operation.

The effect of this, however, being inconsiderable, it has lately been proposed by Mr James Moore of London, to compress the principal nerves so completely as to render the parts beneath altogether insensible. In Plate CI. an instrument is delineated, by which this may be very effectually done.

Whether or not it will answer with ease and certainty, experience alone must determine: But, in the mean time, we are much indebted to the ingenious author,



for affording a hint that eventually may tend to mitigate the sufferings of those whom necessity obliges to submit to surgical operations. All that this instrument seems to require in order to render it perfect, is the power of compressing the nerves of a limb without affecting the veins; for as it is found that the nerves must be compressed for a considerable time, at least an hour, before the parts beneath are rendered altogether insensible, the veins could not be compressed for such a length of time but with the risk of bursting. With a view to prevent such a disagreeable occurrence, Mr Moore proposes that one of the veins in the limb should be opened. But as this might prove hurtful to weakly patients, in whom it is often of importance to guard against the loss of blood, it would be better to avoid it, by having the instrument formed in such manner, that it might compress the principal nerves only, without materially affecting the veins. This  
will

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will not indeed be easily done, as the nerves usually run at no great distance from the veins: But the same purpose may perhaps be answered by compressing the arteries of the limb for a minute or two before any pressure is applied to the veins; by which the latter may be previously emptied.



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CHAPTER XLIX.

*Of MIDWIFERY.*

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SECTION I.

*General Observations on Midwifery.*

**M**IDWIFERY being now considered as a distinct branch of chirurgical actice, a minute account of it will not expected in a System of Surgery. For ore particular information, those authors io have written upon it may be consult- : But I have judged it proper to deli- ate the instruments usually employed in

Midwifery; and to describe two operations, which, although immediately connected with this branch, are yet more frequently performed by the surgeon than the accoucheur; namely, the Cæsarean operation, and the division of the symphysis pubis.

A great variety of instruments have been invented by practitioners in midwifery; almost every publication, indeed, upon this subject, announces some new invention. It is only those instruments, however, which experience has shown to be useful, that I mean to describe: They are not numerous; and are all delineated in Plates CII. CIII. CIV. CV. and CVI.

With the forceps in Plate CII. fig. 2. we lay hold of the head of the child when the mother is much enfeebled and the contraction of the uterus not sufficient to expel the child in the usual way: And when delivery cannot be effected even in this manner, or by turning the child, and bringing it away by the feet, as sometimes happens from the pelvis being much distorted,

storted, we employ the crotchet represented in Plate CIII. fig. 1. for bringing the child away piecemeal, after lessening the size of the head by an opening made in the skull for discharging the brain with the scissars represented in fig. 2. of the same Plate.

The necessity, however, of using any of these instruments I believe to be exceeding rare : They are indeed frequently employed ; but this proceeds in a great measure from impatience on the part of practitioners, who often force the delivery of the child, when nature, if left to herself, would effect it in a much more easy manner. This fact is so certainly well-founded, and is of such general importance, that practitioners of every description, and more especially those who are newly entering on business, should never lose sight of it. By not meeting with that attention which it merits, both the forceps and crotchet are daily employed with too much freedom, to the disgrace of the art, and  
often

often with irreparable injury both to the mother and child.

In some cases it happens, that delivery cannot be accomplished even with the assistance of these instruments, owing to the brim of the pelvis being so narrow that it will not allow any part of the child to pass. In such circumstances, the Cæsa-rean Section, as it is termed, used formerly to be practised ; but the danger attending that operation being so great that the mother was seldom saved by it, Mr Sigault of Paris, about four and twenty years ago, proposed the division of the symphysis pubis, for the purpose of increasing the diameter of the pelvis, and for extracting the child in the usual way, by the vagina.

SECTION II.

*Of the Cæsarean Operation.*

**T**HIS operation may become necessary, as we have seen in the last section, by the brim of the pelvis being so narrow that it will not allow the child to pass; and it may also become proper where the child has been forced into the cavity of the abdomen by a rupture in the uterus, as sometimes happens from the uterus contracting with too much force before the os tincæ is sufficiently dilated.

The Cæsarean Section may be performed, either with a view to save both the mother and child, when the child cannot be extracted in any other manner; to save the mother only when we know that the  
child



child is dead ; or to save the child immediately after the death of the mother.

As there are few instances of the mother being saved by this operation, some have advised that it should never be performed till after the death of the mother. I am clearly of opinion, that an operation attended with so much hazard, should never be advised as long as there is the least reason to hope that delivery may be effected in any other manner : but I also think, that it is the duty of every practitioner to propose it when this cannot be accomplished ; for it is surely better to afford the small chance to the mother that accrues from it, than to leave her with the certain prospect of death ; while by the same means we may be enabled to save the child, which otherwise would be destroyed. None will hesitate in advising it after the death of the mother, when the child is found to be living. The following is the method of performing it.

The patient should be placed upon a table of the usual height, and laid upon  
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her back ; her hands and legs being properly ſecured by aſſiſtants ; her head ſhould be moderately elevated with pillows, and her thighs ſomewhat raiſed, in order to relax the abdominal muſcles. The operator ſtanding on one ſide of the table, is, with a common round-edged ſcalpel, to make an incision, fix inches in length, through the ſkin and cellular ſubſtance, on one ſide of the abdomen : The cut ſhould commence two inches above the umbilicus on the outer edge of the rectus muſcle, and from thence ſhould be carried in a perpendicular direction fix inches downwards. The uterus is now to be laid bare, by carrying the incision through the tendinous parts of the abdominal muſcles, and peritonæum ; and this being done, an opening of the ſame length muſt be made in the uterus itſelf. The eaſieſt method of effecting this, is, to make a ſmall opening with the ſcalpel, ſufficient to admit the finger, to ſerve as a conductor to a probe-pointed biſtouri, with which the remaining part of the incision ſhould be finiſhed. I may alſo remark, that

In order to avoid the risk of hemorrhagies from the uterus, some have advised the incision never to be made at that part where the placenta adheres; while, by others, we are directed to make the opening into the uterus exactly in a longitudinal direction, by which we are told that the principal vessels with which it is supplied will most readily be avoided. No advantage, however, is derived from this: For the incision in the uterus must correspond exactly with the external incision; which cannot with propriety be made in any other direction than the one I have mentioned. Besides, it would often be impossible to distinguish the part at which the placenta adheres; nor is there much ground to suppose that the hemorrhagy from the uterus depends so much upon the direction as on the extent of the incision; and it ought not to be less than six inches in length, as the child could not be extracted with freedom at a smaller opening. It is scarcely necessary to remark, that the child and placenta should be removed as soon  
after

after the incision is made in the uterus as possible. It is thus allowed to contract, which it does instantaneously with great force ; by which the hemorrhagy is more readily stopped than by any means that we could employ for it. .

By others, we are advised to leave a large opening at the under part of the external incision, in order to give vent to any effusion of blood that may happen. No advantage, however, is gained by this, as the incision in the uterus, although opposite to the external opening at first, very soon falls beneath it when it contracts ; by which any blood that is discharged falls into the bottom of the abdomen where it coagulates, and thus cannot be discharged at the wound. And as it is of importance to prevent the air as much as possible from finding access to the abdomen, the external cut should be quickly and entirely shut, by as many sutures as the length of it requires. The most effectual method with which I am acquainted of preventing hemorrhagies is,

the tying of any large vessels in the manner I have mentioned ; keeping the patient cool and free from pain, by regulating the air of the apartment to a proper temperature, and administering opiates ; and by preventing, as I have observed above, every kind of bodily exertion.

SEC.

## SECTION III.

*Of the Division of the Symphysis Pubis.*

**I**T has been long known, that the bones of the female pelvis are connected in such a manner, that during the latter months of pregnancy, and especially during labour, they are separated in some degree from each other; by which the passage of the child is rendered much easier than it otherwise would be. It was a knowledge of this fact, and the great danger attending the Cæsarean operation, that first suggested the idea of dividing the bones of the pubis at their junction with each other in cases of narrow pelvis. It was proposed upwards of two hundred years ago, by a French surgeon of the name of Pineau; but Mr Sigault of Paris was the first who had the merit of putting it in practice, in the year 1777.

The operation is easily performed. The patient must be laid upon her back on a table of a convenient height ; the pelvis should be elevated with two or three pillows put beneath it, and the legs and arms secured by assistants. When in this situation, the bladder must be emptied by the introduction of a catheter, which should be retained in the urethra by one of the assistants till the division of the bones is completed.

After shaving the pubis, the operator, standing on one side of the patient, should, with a longitudinal incision, divide the skin and cellular substance covering the pubes at their symphysis : The cut ought to commence at the upper edge of these bones, and be continued nearly, but not entirely, along their whole breadth : On the bones being laid bare, the cartilage by which they are joined must be slowly and cautiously divided ; and as it is by no means hard, it is easily done. Both the teguments and cartilage, may be divided with a firm round-edged scalpel of the  
common

common form, which is the only instrument except the catheter that is necessary in this operation. The intention of the catheter is, to point out the course of the urethra to the operator ; for it lies so contiguous to the pubes at their symphysis, as to be in great danger of being cut, if this precaution is neglected : even the bladder itself might be injured, were the division of the cartilage not conducted with caution : but, with due attention to these points, and avoiding the total division of the soft parts at the under edge of the bones, all risk of hurting either the bladder or urethra may be prevented.

On the division of the cartilage being completed, the bones recede considerably from each other. To prevent any consequences that might ensue from their separating forcibly and suddenly, the assistants who have the charge of the thighs should be desired to support them, particularly towards the end of the operation ; and if a sufficient opening is not gained in



this manner, the thighs may afterwards be slowly and gradually separated.

The child is now to be delivered in the usual way by the vagina; and this being effected, and the placenta removed, the bones should be immediately put together, and retained as exactly as possible in their situation, by the proper application of a flannel or cotton roller round the pelvis and thighs; at the same time that the patient should be desired to remain as much as possible in one posture. The fore does not require any particular attention: In general, it heals easily with light mild dressings; and for the most part the union of the bones is completed in the course of the fifth or sixth week. The patient, however, should not be allowed to walk, or to put the body into any posture that might alter the situation of the bones, till nine or ten weeks have elapsed.

The chief objection that occurs to this operation is, the small space that is gained by it in that part of the pelvis where space is most required. By separating  
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rating the ossa pubis at their symphysis, these bones do indeed recede to a considerable distance from each other : for the most part the separation that takes place will be at least two inches in length ; but this does not increase the narrow diameter of the pelvis, that is, the bones of the pubis will still remain at nearly the same distance from the os sacrum as before the operation ; and in almost every instance of difficult labour from mal-conformation of the pelvis, we find that it proceeds entirely from the ossa pubis and os sacrum being too near each other. It may often happen, however, that the head of the child may be so situated, that even this separation of the ossa pubis alone may allow it to pass, when otherwise it would have remained entirely above the brim of the pelvis ; and as we do not find that the operation is productive of much danger, for in different instances it has been done more than once on the same person, it should always be advised, when we are convinced that the pelvis is so nar-

row that the child cannot possibly pass through it. It should always be advised in preference to the Cæfarean operation.

If farther experience shall show, that in all cases of narrow pelvis, the child may be delivered in this manner, it should even be preferred to the mode of delivering with the crotchet, which is undoubtedly one of the most barbarous operations in surgery; for while the very intention of the operation is to destroy the child, it often tears and mangles the mother so much that she never recovers from the effects of it.

CHAPTER L.

*Of Opening Dead Bodies.*

**W**ITH a view to discover the seat and causes of diseases, and at the instance of the civil magistrate in cases of violent death, surgeons are employed to open dead bodies ; and to do this with accuracy, every preternatural appearance should be committed to paper. After noting any external marks of disease, we proceed to examine the state of the different cavities and of their contents. When the disease has been evidently seated in one cavity, we do not open the others ; but when they are all to be examined, it is proper to begin with the head.

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The body being placed upon a table of a convenient height, and the head firmly fixed by an assistant, an incision should be made from ear to ear across the parietal bones. The scalp is now to be dissected from the parts beneath; and one-half being turned backward and the other over the face, a common amputating saw is used for dividing the cranium: The division may be begun on the os frontis immediately above the frontal sinuses, and should afterwards be continued backward through the parietal bones and os occipitis. The upper part of the skull is now to be raised with a levator; by which the dura mater may be freely examined; and if we wish to go to the depth of the ventricles only, this may be done without removing the brain. But when our object is to examine the state of the brain and cerebellum, they must both be removed and examined at leisure. This being done, and all the extravasated blood taken off with a sponge, the brain and cerebellum must be replaced with the skull-cap above them. The two  
portions

portions of scalp are now to be drawn over the whole, and secured in their situation by sewing the edges of the cut together from one end to the other, either with the glover's stitch, or in any other way which the operator may prefer. For this purpose narrow tape is usually employed, and a large curved needle with a triangular point.

The cavities of the thorax and abdomen are most effectually exposed in the following manner: Let an incision be made through the common teguments from the top of the sternum to the umbilicus, and let it be continued on each side through the abdominal muscles, from the umbilicus in an oblique direction down to the top of the os ileum: The teguments and muscles must now be dissected from the thorax, till all the cartilages which connect the sternum and ribs are freely laid bare; and being drawn backward, the cartilages must be divided with a strong knife as near as possible to the ribs; when the diaphragm being separated beneath, the under part of  
the

the sternum and cartilages connected with it, being raised and turned upward, the sternum must either be separated from the clavicles, or cut across near to the upper end of it. In this manner the contents of the thorax and abdomen are brought into view, when most of them may be examined without being removed; but when more accuracy is required than this admits of, the whole should be taken out: Or, when a partial examination is only required, that portion of them only may be removed which we mean to inspect:

To prevent the inconvenience resulting from the infusion of much blood and excrement, two strong ligatures should be passed at the distance of an inch from each other round the under part of the alimentary canal and large contiguous bloodvessels, and round the trachea, œsophagus, and large bloodvessels of the neck. The parts between the two ligatures both above and below being divided, the whole viscera of both the cavities may then be easily removed, by dissecting them from  
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the contiguous parts, and raising them up as we go along.

The necessary examination being finished, the effused blood all washed off with a sponge, and the viscera replaced, the teguments must be drawn over them, and stitched together with as much neatness as possible.

In opening bodies that have died of any disease, the operator should be as cautious as possible in avoiding cuts or scratches of his fingers and hands: Various instances have occurred of much distress being induced; and in some cases even death has ensued, from inattention to this circumstance.





## CHAPTER LI.

### *Of EMBALMING.*

IN former times, embalming was practised with more care and attention than it is now. This was a necessary consequence of the desire which then prevailed, of preserving dead bodies for ages. At present it is seldom employed, except for the purpose of preventing bodies from putrefying, during the short space which elapses between the death and burial of the person; and not even with this view, if the corpse be not to be kept longer than is usually done in private life.

The

The following is the present method of embalming. The brain, and all the viscera of the thorax and abdomen, being removed in the manner I mentioned in the last Chapter, they are all, excepting the heart, put into a leaden box with a considerable quantity of an aromatic antiseptic powder, prepared with myrrh, frankincense, cloves, the leaves of lavender, rosemary, mint, sage, and other similar articles; and to these are added a proportion of any odoriferous oils. The blood being removed from the different cavities, and the heart replaced, they are all filled with the same kind of powder, with a due proportion of odoriferous oils or spirits, and the parts afterwards sewed up in the manner I have already advised. By some, too, the mouth and nostrils are stuffed with these powders and oils; and incisions are made into all the fleshy parts of the body, which are also stuffed with them, and afterwards sewed up: But there is no necessity for this, unless the body is to be kept for a great length of time, or to  
be

be carried to a considerable distance. In which case, it is usual, after stuffing the incisions in the manner I have mentioned, to roll all the extremities, as well as the trunk of the body, firmly and separately up with bandages, and to cover the whole with varnish.

The body is now to be laid upon a cerecloth of a sufficient size, which must be applied with as much neatness as possible to the head and every part of the body, and either firmly secured by sewing, or with tapes tied at proper distances. The cerecloth is made of linen dipped in a composition of wax, oil, and resin; which should be of such a consistence as to be sufficiently pliable, without being so soft as to stick to the fingers of those who apply it: It may be coloured with verdegris, red lead, or any other article, according to the fancy of the operator. When two cerecloths are applied, one above another, they are usually made of different colours.

The cerecloth being put on, it was formerly the custom to employ a painter to colour the face ; but this is now very commonly omitted : The dress intended for the corpse is immediately put on ; and the body is either laid in the coffin, or allowed to be exposed, according to circumstances.

CHAP.

## CHAPTER LII.

*Of BANDAGES.*

**B**ANDAGES are employed for various purposes in Surgery; for the retention of dressings; for stopping hemorrhages; for removing deformities; and for effecting the union of divided parts.

As a proper application of bandages is an object of much importance, it is a branch of the art which authors have not neglected: Many treatises have been published upon it; but unfortunately it cannot be taught by description: Experience alone can give an adequate idea of it; nor is it possible to acquire it but

by much manual practice. Hence, in the study of this part of surgery, more advantage is to be gained by practising upon a block, than by reading the most elaborate dissertations. My only intention, therefore, at present is, to offer a few general observations upon bandages.

1. Bandages should be formed of such materials as are sufficiently firm for effecting the purpose for which they are intended, at the same time that they may fit with ease upon the parts to which they are applied.

In some cases a degree of firmness is required, which cannot be obtained from materials of a soft texture: Of this we have examples in the most part of trusses for herniæ, as well as in every bandage requiring much elasticity: But for the most part bandages are made of linen, cotton, or flannel. Till of late, linen was universally used for this purpose; but later experience has shown, that cotton and flannel are preferable. They absorb moisture more readily, whether it be produced

duced by sweat, or as the ordinary discharge of wounds or sores, at the same time that they are better calculated by their elasticity for yielding to the swelling which often takes place in luxations, fractures, and other injuries for which bandages are employed. Flannel was first used for this purpose in the Royal Infirmary here, about forty years ago, by Mr James Rae of this place; and since that period the practice has been generally adopted. The objection made to the use of flannel for bandages, by some practitioners, of its not being so cleanly as linen, is frivolous: Neither of them will be cleanly if not frequently changed, while either of them will be sufficiently so, if this point is attended to.

2. Bandages should be applied of a degree of tightness sufficient for answering the purpose for which they are intended, without incurring any risk of impeding the circulation, or doing harm in any other manner. No advantage will accrue from them, if they be not sufficiently tight



to support the parts affected ; while swelling, inflammation, and even gangrene, will occur if they are too tightly applied.

3. Every bandage should be applied in such a manner, that it may be as easily loosened, and the parts examined with as much accuracy as possible. Thus in fractures of the thigh and leg, where the limb cannot with propriety be frequently raised, we now prefer universally the bandage with twelve or eighteen tails to the common roller. The former can be undone and fixed at pleasure without moving the limb, while a roller can neither be applied nor removed without raising every part of the limb to a considerable height.

4. Bandages should always be laid aside as soon as the purpose for which they are intended is accomplished. This being obtained, no advantage can accrue from them, and they often do harm by impeding the growth of the parts upon which they are applied.

5. I have found it necessary in the course of this work to mention bandages  
for

for many parts of the body. In speaking farther of bandages for particular parts, I shall begin with the head, and proceed downwards to the trunk of the body and extremities.

One of the best bandages for all the upper and back parts of the head, for the forehead, ears, and temples, is a night-cap, with one band to tie it before, and another beneath the chin, as is represented in Plate CVII. fig. 1. The *Couvre-chef* of the French, represented in fig. 2. is most frequently used for these parts ; but it can neither be applied with such firmness or neatness as the night-cap.

For the purpose of making compression on any particular part of the head, the *Radiated Bandage*, as it is termed, may be employed, as is represented in the same Plate, fig. 3. It may also be used for compressing the temporal artery : But for this purpose, the *spring-bandage* represented in Plate V. fig. 2. answers better.

In longitudinal cuts of the head, the *Uniting Bandage*, as it is termed, is used

with advantage. It is formed of a long roller with two heads, with a slit or opening in the middle, as is represented in Plate CVIII. fig. 3. The sides of the cut being drawn neatly together, and covered with a pledget of any simple ointment, the cure is to be effected by means of this bandage, applied in the manner represented in fig. 6. of the same Plate. In cuts of this description, their edges may sometimes be retained together with sufficient exactness by this bandage; and, when this can be done, it should always be preferred to the mode of doing it with sutures.

When it is necessary to retain dressings upon the eyes, it has usually been done by placing a compress over them and retaining it by several turns of a long roller, such as is represented in Plate CVIII. fig. 1. This bandage, when employed for one eye, is the *Monoculus* of authors, and it is termed *Binoculus* when applied to both eyes. But as a roller passed round the head is apt to slip, even when applied in the most exact manner, the *couvre-chef*  
in

in Plate CVII. fig. 2. or the night-cap in the same Plate, fig. 1. should be preferred.

In fractures and cuts of the nose, the dressings are best retained by a proper application of the uniting bandage in Plate CVIII. fig. 3. and a proper application of the same bandage answers best in longitudinal cuts of either of the lips.

In fractures of the lower jaw, we employ a four-headed roller, such as is represented in Plate CVIII. fig. 4. The space left entire between the four heads is applied to the chin, the hole in the centre being meant to receive the apex of chin. The two superior heads are then carried backwards; and being made to pass each other at the occiput, they are afterwards brought forward over the os frontis: They may either be fixed there, or again reflected back, and fixed with pins on the sides or back-parts of the head. The two under heads of the roller being reflected over the chin, are then to be turned upwards, and either tied or pinned on the top of the head; or before fixing them, they may be  
be

be made to pass each other two or three times. Various other bandages are described by authors for the head; but those I have mentioned, with a proper application of the common roller, Plate CVIII. fig. 1. for particular purposes, are all that can be ever required.

6. In Plate LVI. fig. 1. an instrument is delineated for one of the most material operations upon the neck, Bronchotomy; and in Plate LIV. fig. 1. another is represented for the wry neck: A common roller may be made to answer every other purpose that can be required of a bandage in any part of the neck.

7. A variety of bandages are used for the shoulders and contiguous parts, particularly for fractures of the scapula, and fractures and luxations of the clavicle. In fractures of the scapulā, a proper application of a long roller may, in most instances, prove useful; but in Chapter XXXIX. Sect. V. I have shown, that no utility is derived from bandages in fractures of the clavicles: They cannot be applied with  
such

such tightness as to compress the fractured bone without impeding respiration; and besides, we do not find that they are necessary, when the arm of the affected side is properly supported by the sling, Plate XCIX. fig. 2.

The most useful of all bandages for the thorax and abdomen, at least for the retention of dressings on any of these parts, is that which we usually term the Napkin and Scapulary, represented in Plate CIX. fig. 1. That part of it which goes round the body A, is termed the Napkin. When applied for making pressure upon a fractured rib, it should be in the form of a roller, and should pass two or three times round the body: when only used for retaining dressings, it should not go more than once round: It should be six or seven inches broad for an adult; and secured by pieces of tape, tying it at each end, instead of pins. The Scapulary B C, consists of a slip of linen, cotton or flannel, about three inches broad, and of a length sufficient to reach from the upper part of the napkin behind,

behind, to pass over the shoulders and be pinned to it before : It is sometimes made with a hole in the centre for passing over the head ; but it answers better to divide the anterior end of it by a longitudinal slit into two, and, in applying it, to make one of these slips pass on each side of the neck.

This bandage answers the purpose better than any other, for making pressure on the parts at which the viscera protrude, in umbilical and ventral herniæ. As in such cases it is a point of much importance to have the bandage firmly fixed, we not only employ the scapulary for preventing it from slipping down, but a strap connected with it behind is passed between the thighs, and pinned to it before, to prevent it from slipping up.

In Plate LXII. fig. 2. a bandage is represented for compressing the abdomen in the operation of tapping ; and in Plate LXIV. different bandages are delineated, or Trusses, as they are termed, for the retention of the protruded viscera in cases of hernia.

9. As it is of much importance in various diseases, as well as in several operations, to have the scrotum properly supported, I have delineated some bandages for this purpose in Plate CX. The best bandage for the penis is a pouch, or bag of linen or cotton, to be fixed by a roller, or two pieces of tape passed round the body.

The T-bandage, as it is commonly termed, Plate CIX. figures 3. and 4. is usually employed for the retention of dressings about the anus and perineum, as well as for some disorders of the scrotum; but in the last, one or other of the suspensory bandages, represented in Plate CX. will for the most part be found preferable.

10. In compound fractures of the arm, fore-arm, or hand, where motion of the limb would prove hurtful, the twelve or eighteen-tailed bandage is equally proper as in similar affections of the lower extremities; but in simple fractures, as well as in almost every other affection of these parts,



parts, we prefer a proper application of the roller.

.II. I advised the uniting bandage for longitudinal cuts in the head ; it answers equally well in wounds of a similar nature in every part of the extremities, as is represented in Plate CVIII. fig. 6.

END OF VOLUME SEVENTH.



PLATE LXXVIII.

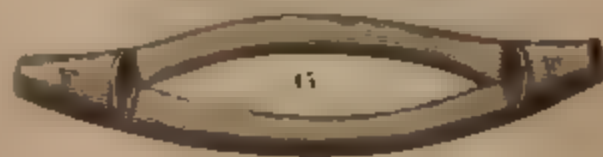
Fig. 1.



Fig. 2.



Fig. 3.



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EXPLANATION  
OF THE  
P L A T E S,

---

PLATE LXXXVIII.

**Fig. I.** **T**HIS represents the Ambe of Hipporicates, for the reduction of luxations of the humerus : It consists of a fulcrum and moveable lever. As it is still used by some practitioners, I judged it proper to mention it ; but I have elsewhere had occasion to remark, that it is a dangerous instrument, and ought never to be employed. My reasons

sons for thinking so are enumerated in Chap. XL. Sect. IX.

Fig. 2. Mr Petit's instrument for reducing luxations of the humerus. *A A*, Two arms or horns, by which the scapula is kept firm during the extension. *B B*, The other end of the instrument resting upon the ground; *C*, the pulleys; *D*, ropes, by winding up which with the handle *E*, the limb may be slowly and gradually extended to any necessary degree.

Fig. 3. *G*, An opening through which the arm is passed; *F F*, two apertures for receiving the ends *A A* of the instrument, fig. 2. This being made of firm leather, the instrument is thereby prevented from fretting or galling the skin.

### PLATE LXXXIX.

Fig. 1. The ambe of Hippocrates, represented by itself in the preceding Plate, is here applied, and ready to be used.

Fig.

PLATE LXXX.

Fig. 1.



Fig. 3.

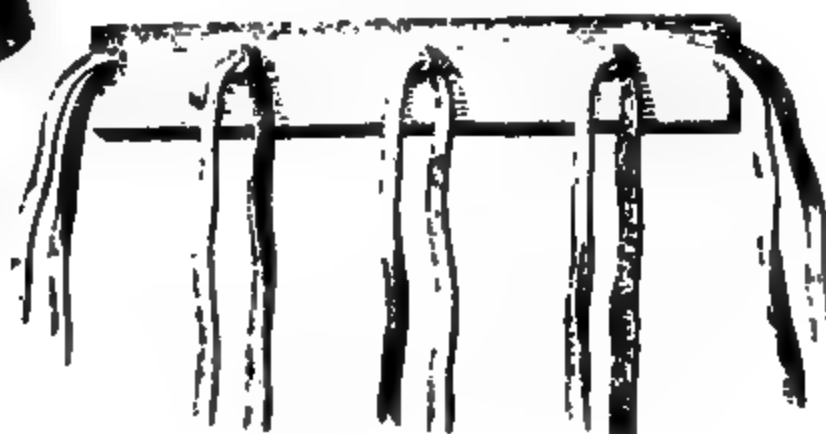








PLATE NO.

Fig. 1.



Fig. 2.



Fig. 3.



Fig. 4.

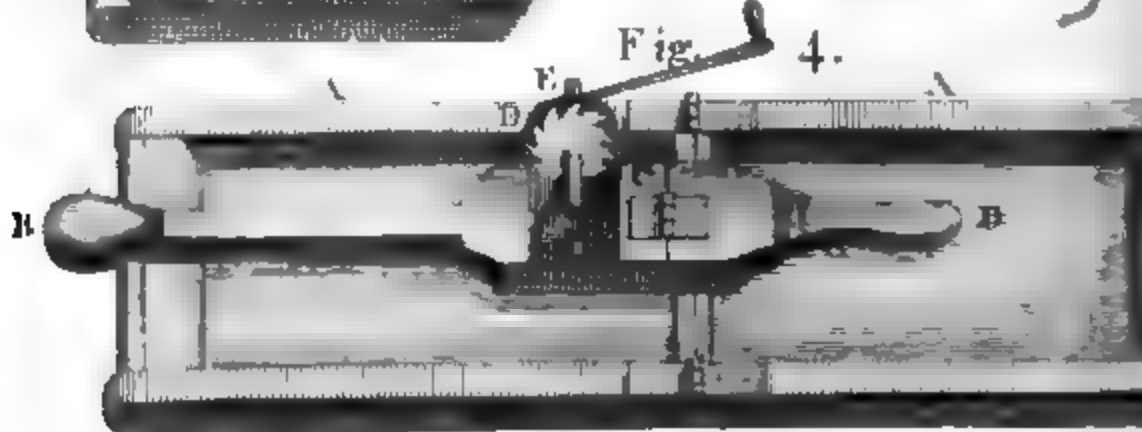


Fig. 2. Pullies for extending dislocated bones.

Fig. 3. This is a very useful part of the apparatus for extending dislocated limbs : It is formed of thick shamoy or buff leather. By tying it firmly round the limb with the broad straps at each end, a very considerable force may be applied by assistants pulling the ropes or straps passed over the hooks : It answers the purpose both more easily and more effectually than the common method of extending the limb with towels.

### PLATE XC.

In this Plate I have delineated one of the best instruments hitherto known for dislocations of the shoulders, when more than ordinary force is required. It is the invention of the late Mr Freke of London.

As instruments of this kind require to be very portable, Mr Freke has paid particular attention to this circumstance. The

box, fig. 5. contains the whole apparatus: When shut, it is only one foot eight inches long, nine inches broad, and three inches and a quarter deep. Fig. 4. represents the instrument open, the two sides of the box being firmly fixed together by brass hinges at C, and with two hooks and eyes on the other side of the box. When one end of it is fixed on the ground, the other stands high enough to become a fulcrum or support for the lever *B B*, which is fixed on the roller *E* by a large screw of wood, which turning sideways, as well as with the roller, it obtains a circumrotatory motion, so that it may serve with proper attention to reduce a luxation either backward, forward, or downward.

The roller on which the lever is fixed is just the diameter of the depth of one of the boxes, into which are driven two iron pins, the ends of which are received by the two sides of the box, which are an inch thick.

The

The lever is two feet four inches long, and is cut and joined again by two hinges at *C*, to fold up so as to be contained in the box : On the back-side of it is a hook to keep it straight ; the other end of it hangs over the roller an inch and a half, which is to be excavated and covered with buff-leather for the more easy reception of the head of the os humeri.

The iron roller *E*, has two holes through it for receiving two cords from a brace, fig. 3. fixed on the lower head of the os humeri, for on no other part of the arm above the cubit can a bandage for this purpose be useful ; for, if the surgeon applies it on the muscular part of the arm, it never fails to slip down to the joint before the limb can be extended.

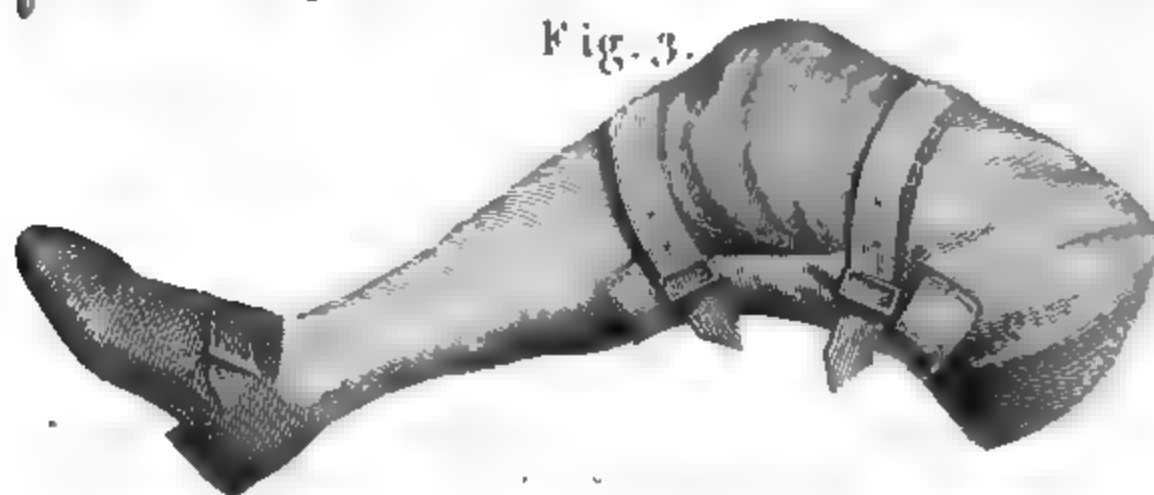
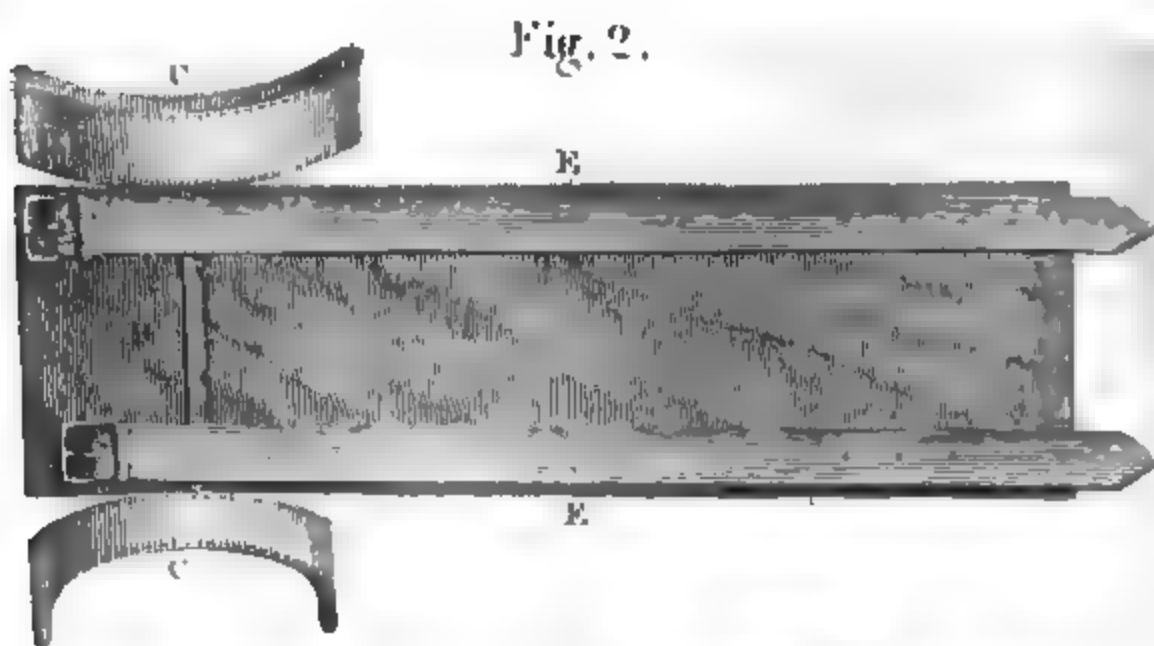
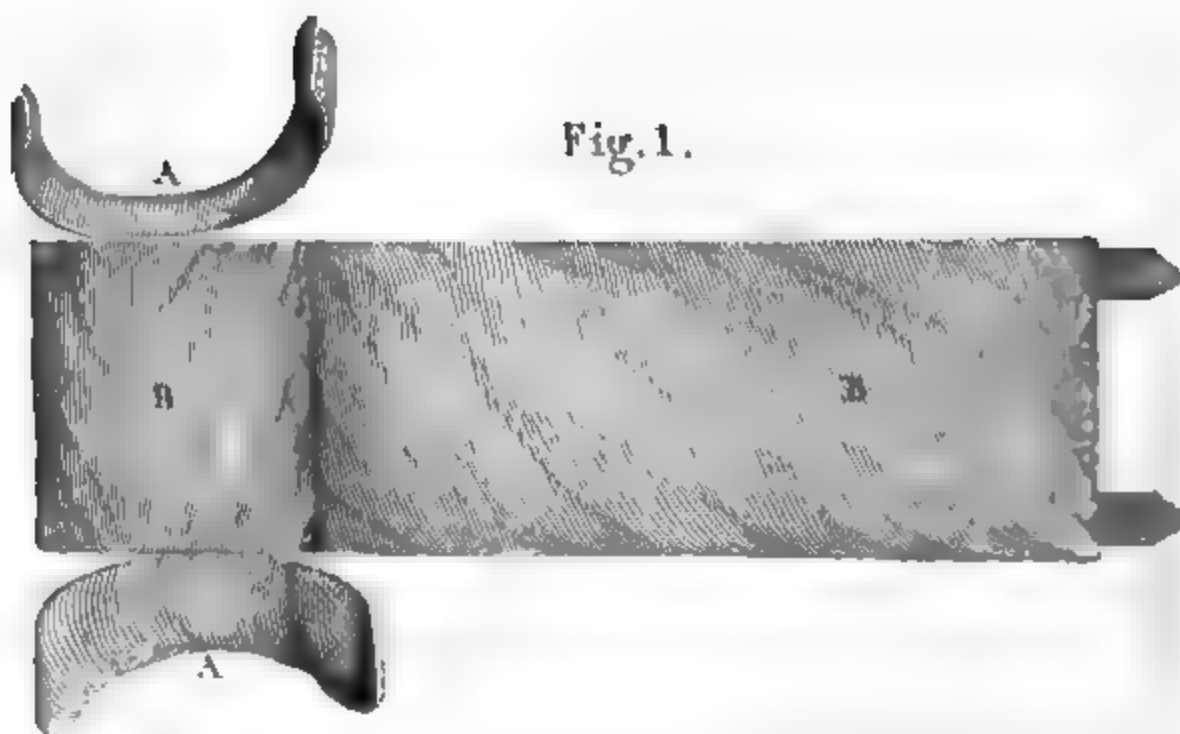
The iron roller *E* has a square end, on which is fixed a wheel *D*, notched round, which works as a ratchet on a spring ketch under the lever ; by which it is stopped as it is wound up with a winch, so that at pleasure it may be let loose by discharging the ketch.

The brace, fig. 3. consists of a large piece of buff-leather, large enough to embrace the arm, sewed on two pieces of strong iron curved plates rivetted together, one of them having an eye at each end to fasten two cords in : The other is bent at the ends into two hooks, which receive the cords after they have crossed the arm above.

In order to keep the patient steady in his chair, and to prevent the scapula from raising or depressing the lever, after the limb is drawn forward by the winch, there must be fixed over the shoulder a girth with two hooks at the end of it, such as is represented in fig. 2. The girth should be long enough to reach the ground on the other side, where it must be hooked into the ring *B*, screwed into the floor for that purpose, as in fig. 1.



PLATE XCI.



## PLATE XCI.

The figures in this plate represent an instrument mentioned in Chap. XLI. for the purpose of removing contractions of the ham-strings or flexor tendons of the leg.

Fig. 1. A front view of the instrument: *A A*, two curved steel plates connected together by a firm steel splint *D*, in fig. 2. One of these is to be applied to the back part of the thigh, and the other to the upper and back part of the leg; while, by means of the leather straps *E E*, such a degree of pressure is made as the patient is able to bear.

*B B*, fig. 1. Is a soft cushion of quilted cotton for surrounding the limb to prevent excoriation by the leather straps. The curved plates *A A* should for the same purpose be lined with shamoy.

Fig. 2. A back view of the same instrument.



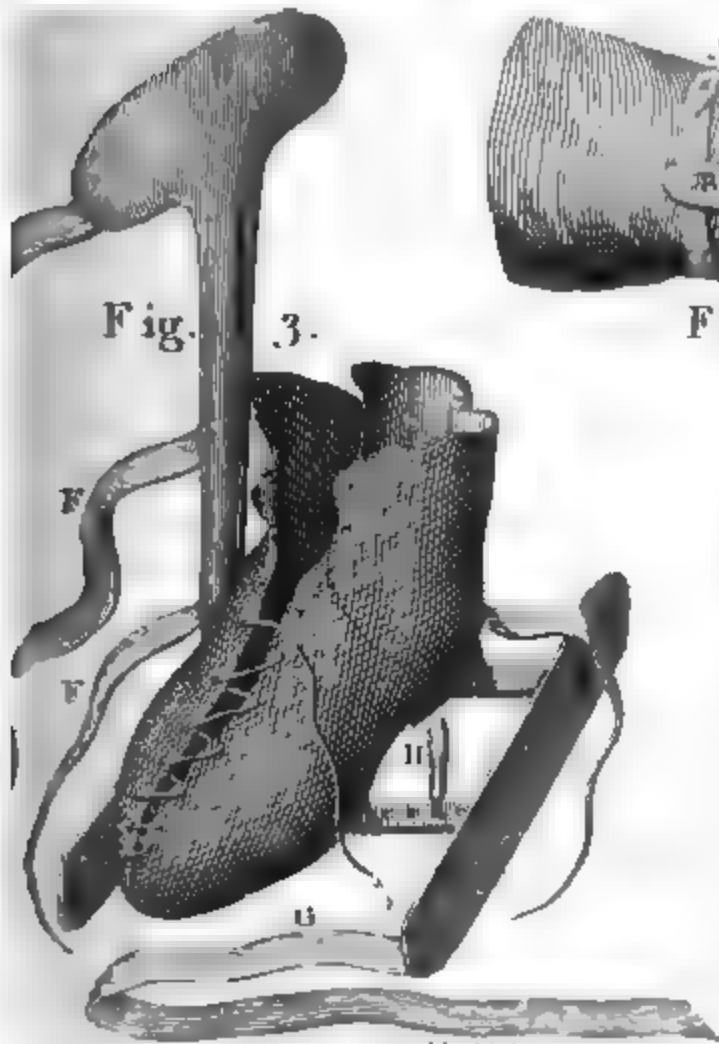
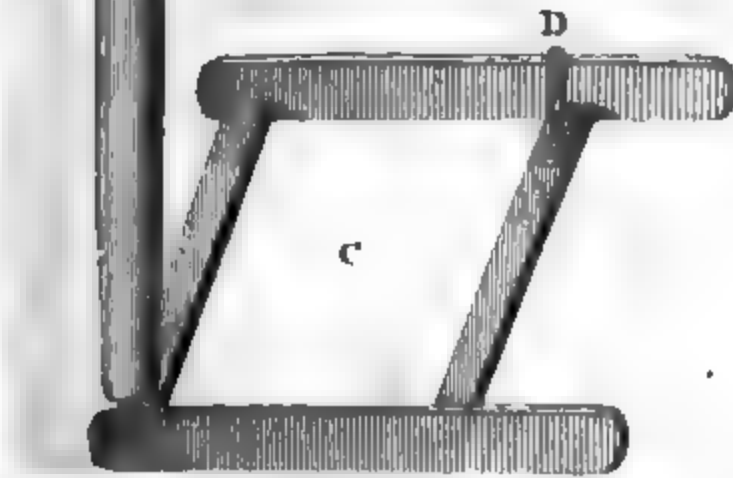
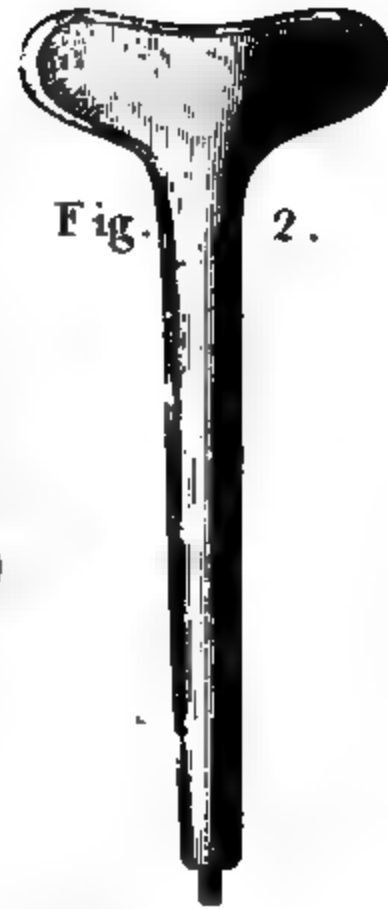
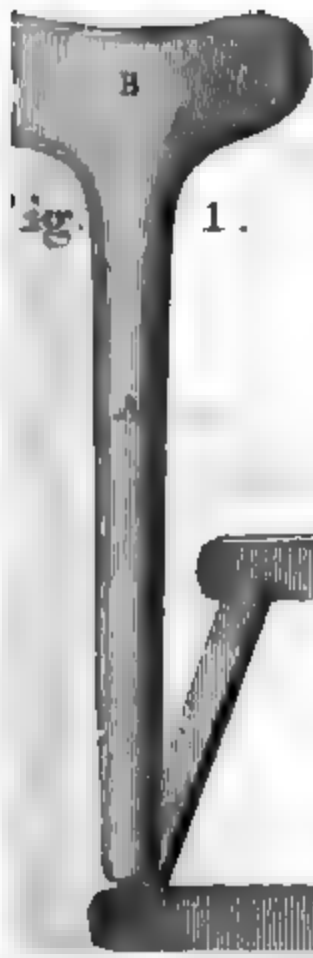
Fig. 3. A limb with the instrument applied on it.

## PLATE XCII.

In this Plate I have delineated an apparatus mentioned in Chap. XLI. for distortions of the legs.

Fig. 1. *A B*, An iron splint properly covered with soft leather fixed in an iron frame *C*. The splint may be made to fix on either side of the frame according as the leg is curved to one side or another. In a distorted leg the foot is to be fixed down to the frame *C* by means of the shoe represented in fig. 3. This is easiest done by passing a nail through the heel of the shoe into the frame, upon which the shoe may move. If the leg is bent outward, the splint *A B*, fig. 1. is placed on the inside, and it should be of such a length that the pad *B* may rest upon the internal condyle of the knee-joint, where it should be fixed by the strap *E*, fig. 3. When the bones

PLATE XCH.





bones are bent inward, the splint must be placed on the outside of the leg.

The straps *FF* must be passed two or three times round the convex part of the leg, which it ought to compress with some degree of force toward the splint; and by increasing the pressure from time to time, the curvature or convexity will be gradually lessened till at last it may in many instances be totally removed. By means of the strap *G*, fig. 3. the toes are to be drawn from that side to which they incline, and fixed to the opposite side of the frame. The screw-nail *D*, fig. 1. determines what is gained from time to time, by moving it from one hole in the frame to another.

Fig. 4. A machine invented by the late Mr Gooch, for giving support to weak limbs as well as for removing distortions. *AAA*, three steel-bows made thin and very elastic: They must stand clear of the tibia; must pass about half round the limb, and be fixed with straps of leather upon round-headed pins.

*D d 4*

*B B B,*

*B B B*, a longitudinal plate, to be made of tough stuff, as the workmen term it, and as light as possible with sufficient strength.

*C*, the shank to pass into the socket, in that part of the machine which is to be fixed into the heel of the shoe or laced boot, and confined there by a screw at the bottom.

*D*, The screw to keep the shank in the socket.

### PLATE XCIII.

Fig. 1. A machine invented by an ingenious tradesman of this place, the late Mr Gavin Wilson, for distortions of the leg. This subject was treated of in Chap. XLI. *A*, a case of firm leather open before, for receiving the distorted leg and foot. *B*, a splint of iron for giving additional firmness to the case. The leg being placed in this case, the foot is fixed down to the bottom or sole by the strap *H* passed through the hole *I*; and the leg  
itself

PLATE XCH.

Fig. 1.

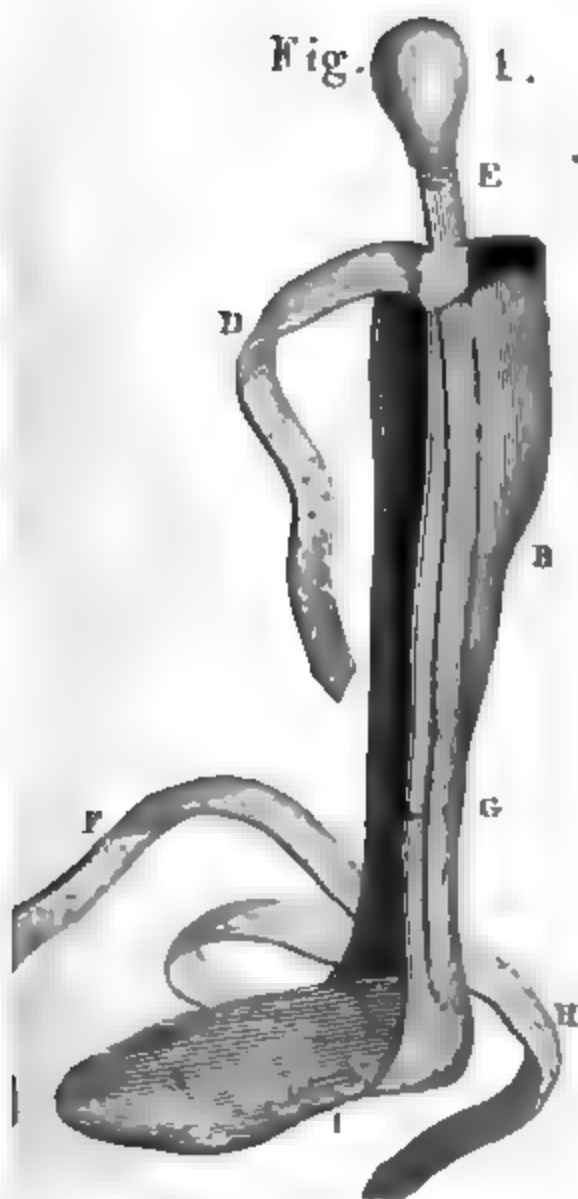


Fig. 2.



Fig. 3.

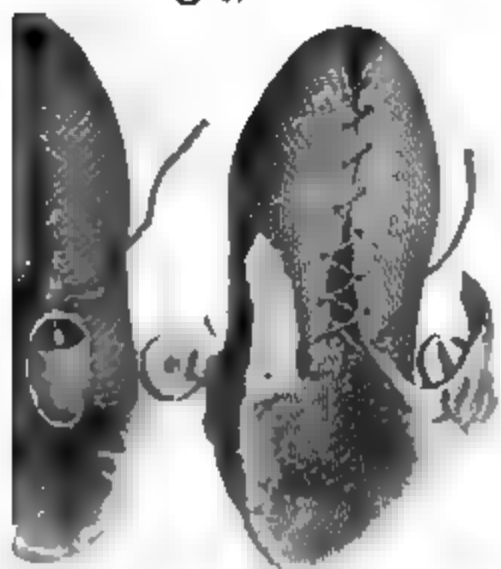


Fig. 4.

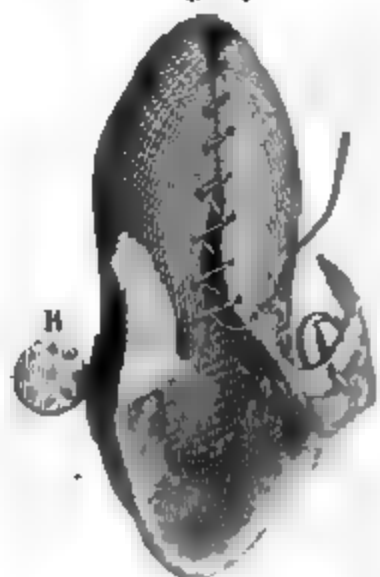


Fig. 5.





2

2

itself is gradually drawn either to one side or another according to the nature of the distortion, and secured by a proper application of the straps *DF*, fixed upon the brass hooks *GE*. By a due perseverance in the use of this machine, many bad cases of distorted limbs have been completely cured.

Fig. 3. A pair of shoes which have proved useful in some cases of distorted ankle-joints, where the toes have been turned too much inward. Being light, they may be used even in early infancy. After the feet are fixed in the shoes by the laces before, the toes may be separated to a proper distance, and preserved in this situation by the apparatus at *A*; which consists of three small iron plates, more particularly delineated in fig. 5. and at *B*, fig. 4. Fig. 5. consists of two parallel thin plates, fixed with nails to the outside of the sole of one shoe; and they are so far separate from each other, as to receive the round plate *B* between them, the end of which is fixed to the sole of the

the



the other shoe. The three plates are connected together by a nail passing through the hole in the centre of all of them. This admits of a considerable degree of motion, by which the toes may be moved either outward or inward; but they can be easily fixed at any particular point by a small iron pin at *A* passed through one or other of the holes in the side of the plates *B*.

#### PLATE XCIV.

In this plate I have delineated two machines for supporting the head and shoulders, commonly employed in distortions of the spine.

Fig. 1. *A*, An iron collar properly covered for passing round the neck. By means of the long iron plate connected with it, it may be raised or depressed at pleasure. *B B B*, a broad iron plate fitted to the back and shoulders. *C C*, two straps to be carried over the shoulders; and being brought through beneath the arm-pits,

PLATE XCIV.

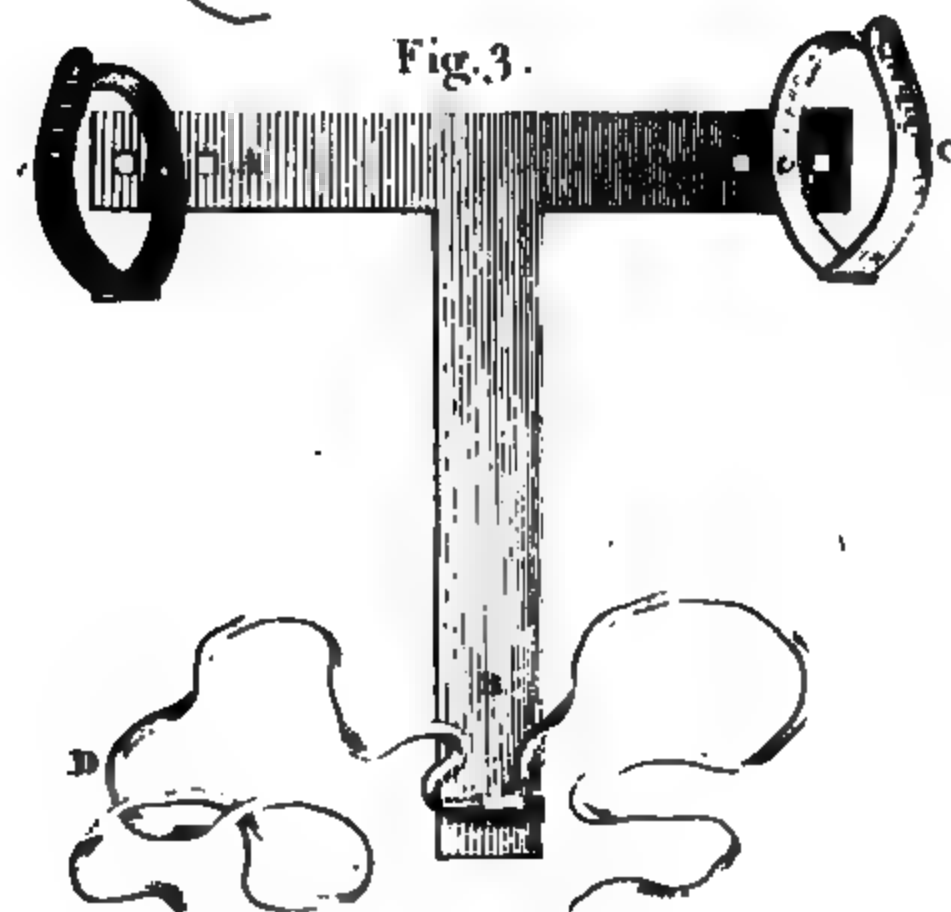
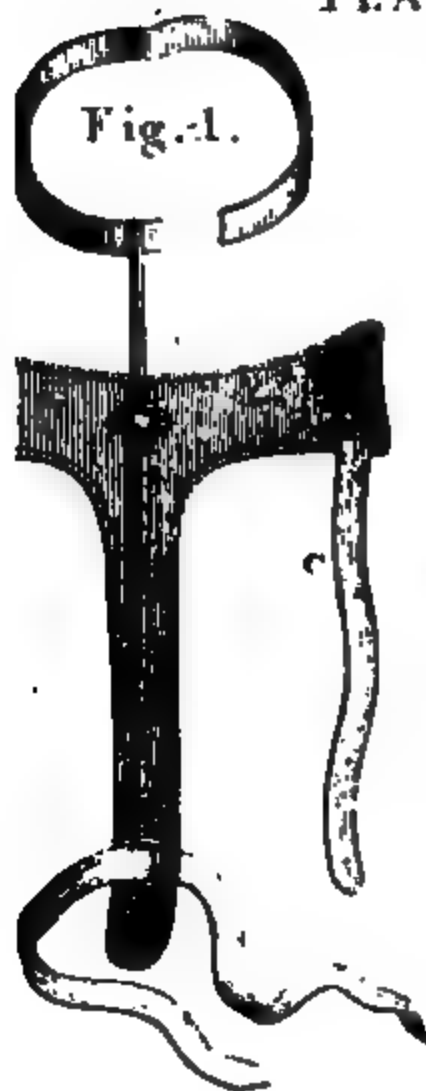






PLATE XCVI.

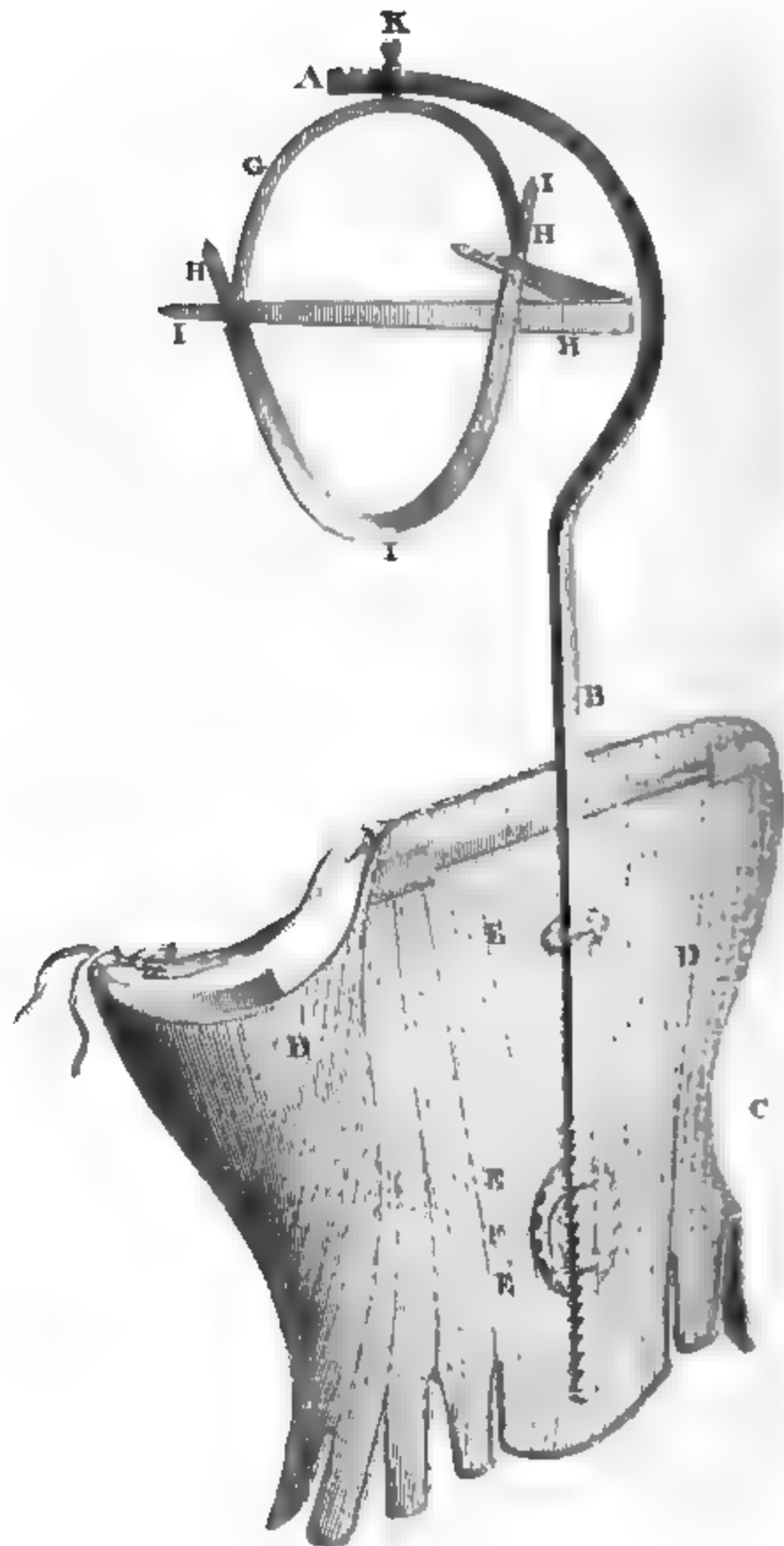




PLATE XCV.



pits, to be fixed, of a sufficient tightness, on two knobs on the shoulder-plates, as may be seen in fig. 2. *D*, a strap for fixing the plate going down the back, by tying it round the body.

Fig. 3. An iron or steel instrument, delineated by Heister for the same purpose with the preceding. *AA*, its transverse part, to which are fastened iron rings *CC* for retaining and keeping back the shoulders. *B*, the perpendicular part going down the back. *D*, a band or ligature passing through an aperture in the lower end of the plate *B* for tying it firmly to the body.

PLATES XCV. and XCVI.

In these plates are represented an apparatus for removing curvatures of the spine. The invention is very ingenious, and we owe it to Mr Le Vacher, who made it public in the year 1768, in the 4th Volume of Mémoires de L'Académie Royale de Chirurgie de Paris. It has since  
that



that period been improved by Mr Philip Jones of London.

The chief intention of this instrument is to support the head, and gently to stretch the spine: The stays *DD*, Plate *XCVI.*, to which the instrument is attached, must be exactly fitted to the patient: *EEE*, are three loops of iron fixed to the stays, through which a firm steel-rod *ABC* is passed to such a height, that the point of the curve at *A* may nearly touch the fore-head: *G*, is another curve of polished steel, neatly adapted to the upper part of the head, over which it passes from ear to ear; and it is attached in a pendulous state by the screw *K* to the rod *ABC*, upon which it moves backward from *A* at pleasure. *HHH*, is a strap of firm leather, covered with silk, passing round the occiput, and fixed sufficiently tight on two hooks or knobs to the two ends of the curve *G*. *II* is another strap of the same kind that passes beneath the chin, and is also attached by knobs or hooks to the curved plate *G*. On a proper application

cation of these straps, the utility of the instrument in a great measure depends. The one should cover the chin, and the other be entirely below the occiput, and both of a degree of tightness adapted to the feelings of the patient.

The instrument being fitted to the patient in the manner represented in Plate XCV. the head is thereby completely supported, at the same time that the body is kept erect by the steel-rod *A B C*. This rod should at first be placed as high as the patient can easily bear it, and every three or four days it should be raised, which is easily done by touching the spring *F*; and after drawing the rod upwards, it is again firmly fixed by letting the spring fall into the corresponding notch.

In all curvatures of the spine, this machine proves useful, particularly where the disease is recent; but it requires to be worn for a great length of time: It soon tends to lessen the deformity, but the parts quickly return to the same degree of curvature

vature if it be not continued for two or three years.

### PLATE XCVII.

Fig. 1. The saw that I always use in amputating legs and arms: It should be seventeen inches in length, including the handle, and two inches and a quarter in breadth at its broadest part.

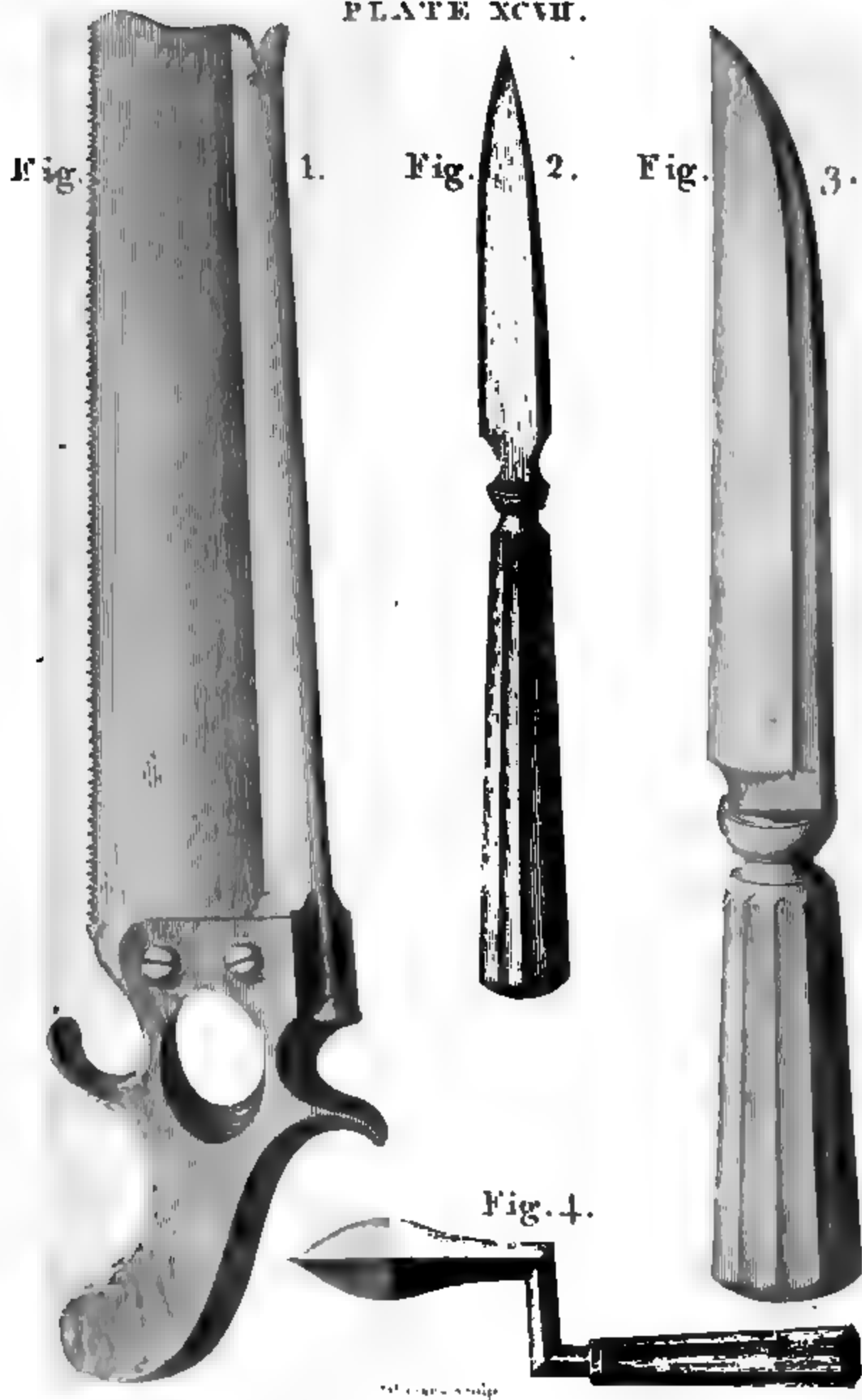
Fig. 2. A small double-edged knife, commonly termed a Catline, for dividing the interosseous ligaments and other soft parts in amputating the leg and fore-arm: It should be nine inches long.

Fig. 3. An amputating knife, which answers either for the thigh, leg, or arm: It should be thirteen inches in length.

Fig. 4. A small crooked knife for separating the muscles from the bone in the manner I have advised in Chap. XLIV. Sect. IV.

PLATE

PLATE XCVII.







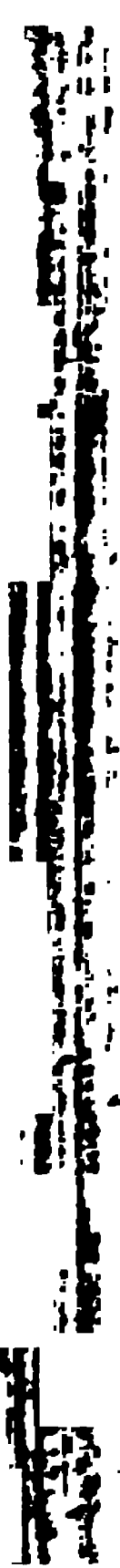






PLATE XIX.

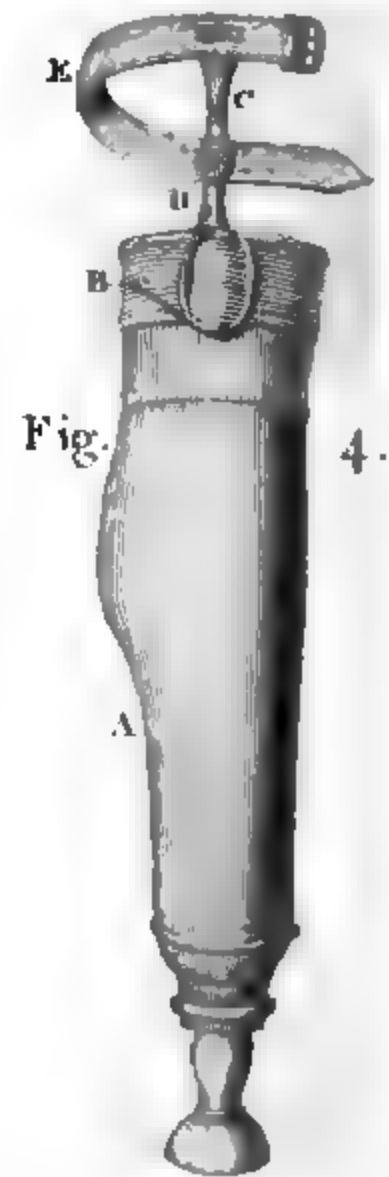
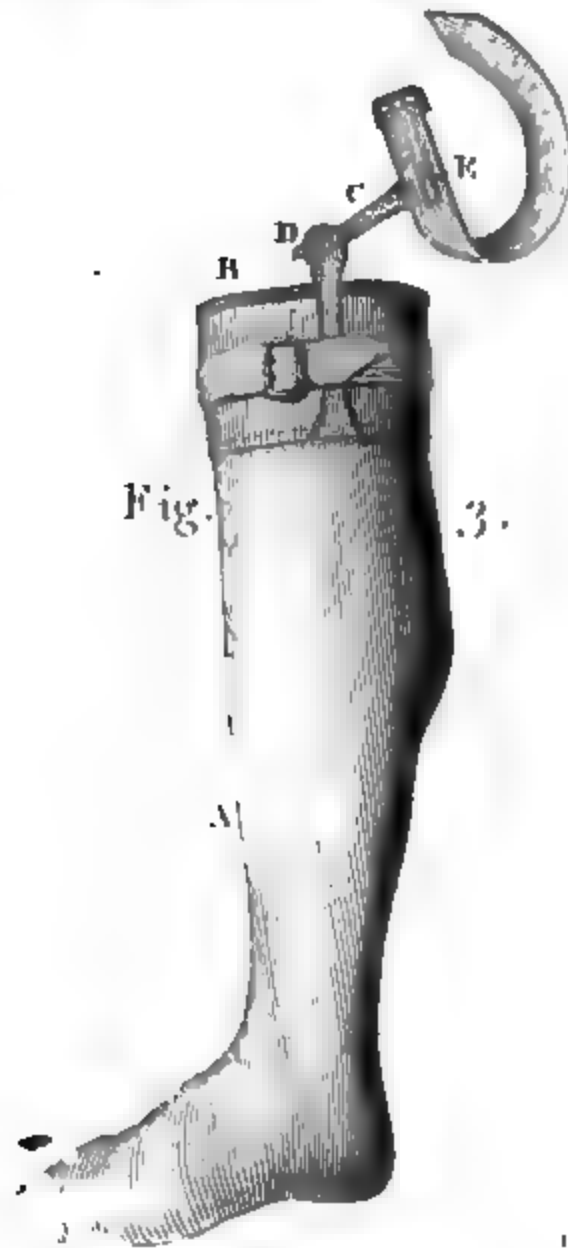
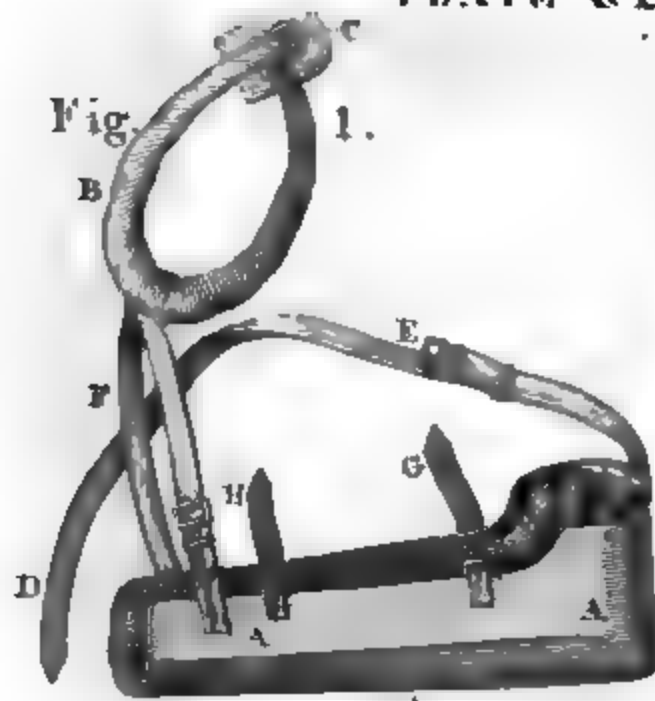
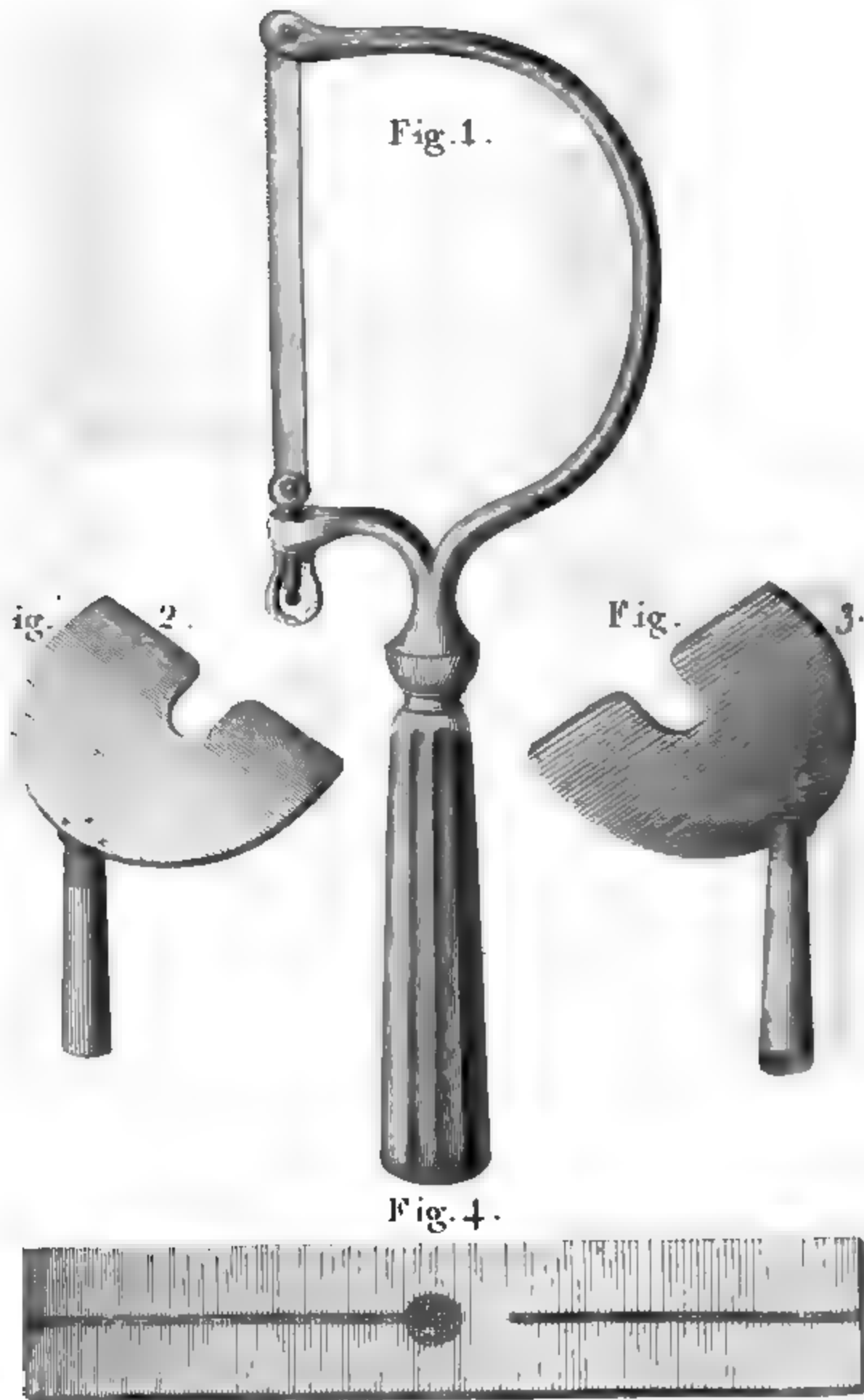




PLATE XCVIII.



## PLATE XCVIII.

Fig. 1. A small spring-saw used in amputating fingers and toes.

Figs. 2. and 3. Retractors made of thin iron plates for drawing up and supporting the muscles and other soft parts in amputating limbs while the saw is applied to the bones. They should be kept with openings of different sizes, so that they may answer whether the bone is large or small. These retractors were first proposed by Dr Monro, and they answer the purpose with much ease to the operator, and perfect safety to the patient.

Fig. 4. A piece of firm slit leather, which also answers the purpose of a retractor. Leather is better suited for this than linen, which is generally used, but neither the one nor the other answer so well as plates of iron.

## PLATE XCIX.

In Chapter XCIX. Section V. as well as in other parts of this work, I had occasion

casion to recommend a case for supporting the fore-arm as preferable to any bandage. A representation is given of it in fig. 1.

*A A*, a case or frame of firm leather, properly lined with flannel or wool, of a sufficient length for covering the arm from the elbow to the point of the fingers. This is intended for the left arm. *B*, a collar of soft buff-leather for passing over the right arm, in order to support the fore-part of the case by the strap *F* passing over the left shoulder, to be fixed to a buckle at *C*, to prevent the collar *B* from slipping down. *G H*, Two straps and buckles for fixing the arm down to the instrument.

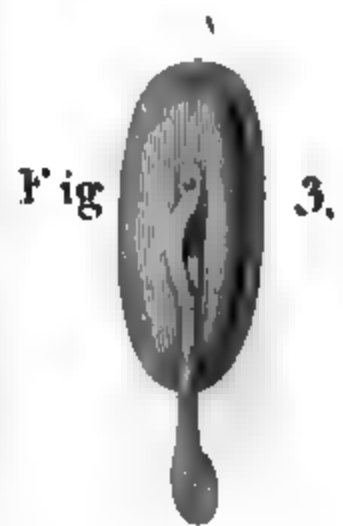
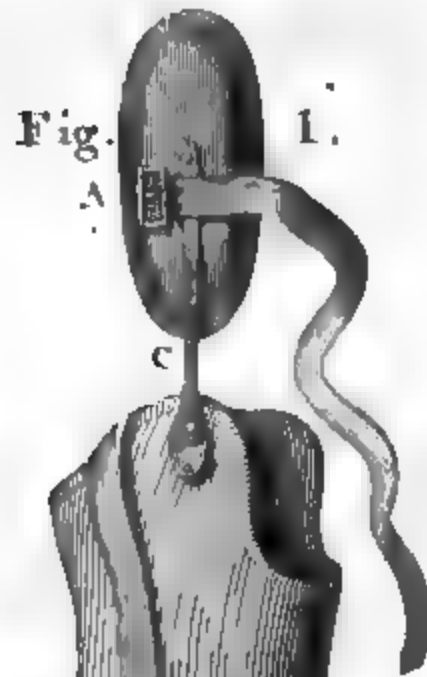
The application of this instrument will be better understood by the view of it in fig. 2.

I was favoured with this instrument by Dr Monro, to whom, I believe, it was sent by Mr Park of Liverpool.

Figs. 3. and 4. Two artificial legs, delineated by Mr White of Manchester in  
his



PLATE C.



**his Cases in Surgery.** Fig. 4. *A*, a hollow leg made of tin, and covered with thin leather. *B* a leather strap with a buckle on the outside, for fixing it below the knee. *C D*, longitudinal steel bars, to be made as tough and light as possible, with sufficient strength. These bars are joined by a moveable joint, to be placed exactly opposite to the knee-joint. *E*, a steel bow made thin and elastic, to pass about two-thirds round the lower part of the thigh, and fixed with straps of leather to buckle on the fore-part.

Fig. 3. Another artificial leg made in the same manner with fig. 4. with the addition of a foot made of light wood and moveable joints, so as to imitate pretty nearly the natural motions of the joints of the ankle and toes.

### PLATE C.

In this plate I have given a representation of an artificial leg and arm made by an ingenious artist of this place, who



I have in different parts of this Work had occasion to mention, the late Mr Gavin Wilson.

Fig. 1. An artificial leg made of firm hardened leather.

*A*, An oval piece of the same kind of leather, lined with shamoy, fixed upon a plate of iron *C*, and moving upon an axis at the knee. The strap, with the buckle connected with it, serves to fix it to the thigh. There must also be an oval piece connected with a similar iron plate on the opposite side of the thigh: These iron plates and oval pads should together go about nine inches up the thigh.

*B*, a strap that comes from the sole of the foot, and goes up the inside of the leg to the middle of the thigh, where it is fixed by a buckle to a strap coming from the opposite shoulder: This serves to support the leg, and to take the weight of it more effectually from the weak side than any invention I have met with.

Fig. 3. The oval piece of leather and iron splint to which it is fixed,

Fig,

Fig. 4. A piece of soft shamoy leather, which fixes by a buckle and strap round the condyles at the knee. In this kind of leg, the person's weight rests upon the condyles and patella, the stump itself hanging quite free within the leg. The band or strap serves in the most effectual manner to prevent pain and excoriation, which otherwise would probably ensue from the friction of the leg against the knee.

Fig. 2. A fore-arm and hand made of the same kind of leather, and made to fix to the arm and shoulder by the straps *D E*.

These artificial legs and arms are preferable to any I have ever seen. The leg, when properly fitted, proves equally useful with the common timber leg, and it is preferable by being neater; at the same time that it is not apt to break, an accident to which the others are liable: And it answers better than a leg made of copper, from being considerably light-

er, and not apt to be hurt in its shape by bruises.

Mr Wilson makes three different kinds of legs corresponding to the part at which the limb is amputated. In amputating the leg lower than the usual part, that is, in such a manner that the motion of the knee is to be retained, it answers better at the distance of nine or ten inches from the condyles of the knee than either higher or lower. When higher, the remaining part of the leg does not support the artificial leg in walking; and when much lower, the machine must be thicker about the ankle than would otherwise be required, by which it is rendered clumsy and heavy. Fig. 1. in this plate represents a leg for this part.

The second kind of artificial leg which Mr Wilson makes is intended for those who have lost the leg at the usual place below the knee, where the weight of the body rests on the knee-joint and upper part of the leg upon a soft-stuffed cushion.

These

These legs have no flexion at the knee, and the hollow for receiving the thigh goes up near to the hip: It opens behind to admit the thigh; it is fixed with three straps and hooks, which last are not only stronger, but less bulky than buckles.

When a limb is amputated above the knee, a joint is formed in the artificial leg at the knee. In walking, the limb is made steady by a steel bolt running in two staples on the outside of the thigh, being pushed down; and when the patient sits down, he renders the joint flexible by pulling the bolt up. This is easily done, and it adds much to the utility of the invention.

The rest or support in this leg is obtained in part from its embracing the upper part of the thigh tightly, but chiefly from the back-part of the thigh-box being stuffed in such a manner that the lower part of the hip rests upon it with nearly the same ease that one does in sitting on a stuffed chair; and, in fact, a person sits on it when he either stands or walks; by which,

and by the strap carried up from the sole of the foot to the shoulder, the limb is easily carried about.

Mr Wilson's artificial arms, besides being made of firm hardened leather, are covered with white lambskin, so tinged as to resemble the human skin. The nails are made of white horn, tinged in such a manner as to be an exact imitation of nature.

The wrist-joint is a ball and socket, and answers all the purposes of flexion, extension and rotation. The first joints of the thumb and fingers are also balls and sockets made of hammered plate-brass, and all the balls are hollow to diminish their weight. The second and third joints are somewhat similar to that which anatomists term *Ginglimus*, but they are so far different as to admit of any motion, whether flexion, extension, or lateral.

The fingers and metacarpus are made up to the shape, with soft shamoy leather and baked hair. In the palm of the hand there is an iron screw, in which a screw-nail

naïl is occasionally fastened. The head of this nail is a spring-plate, contrived in such a manner as to hold a knife or a fork, which it does with perfect firmness; and by means of a brass ring fixed on the first and second fingers, a pen can be used with sufficient exactness for writing.

When only a hand and fore-arm is needed, it is fixed to the arm above the elbow by a strap of leather sewed to one of the sides of the artificial fore-arm. After making a turn and a half just above the elbow, the strap is fixed on the back part of the limb at *D*, fig. 2.

When the arm is amputated above the elbow, the artificial limb is made with an elbow-joint. This part of it is made of wood, and has a rotatory motion as well as that of flexion and extension.

I have given this particular account of Mr Wilson's invention, from a conviction of its being superior to any with which the public is acquainted: I am also pleased at having it in my power to let the

merit of such an artist be more generally known than it otherwise might be.—Indeed his merit was so conspicuous, that his death I consider as a public loss, at the same time that I often wished that some public encouragement had been given him, to enable him to communicate as much as possible the result of his experience to others.

### PLATE CI.

In Chap. XLVIII. I gave some account of an ingenious proposal by Mr Moore of London, for diminishing and preventing pain in several operations of surgery. It is done by compressing the nerves of the limb upon which an operation is to be performed. In this Plate, I have represented the apparatus recommended by Mr Moore for this purpose.

Fig. 1. *A*, The compressing instrument, being formed of a curved piece of iron covered with leather, and of sufficient capacity

PLATE C1.

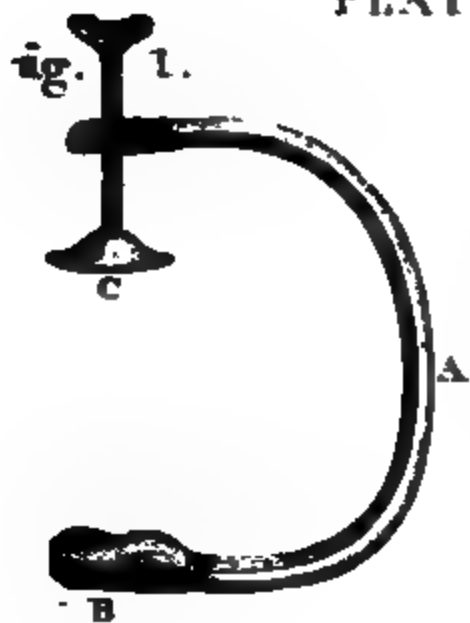
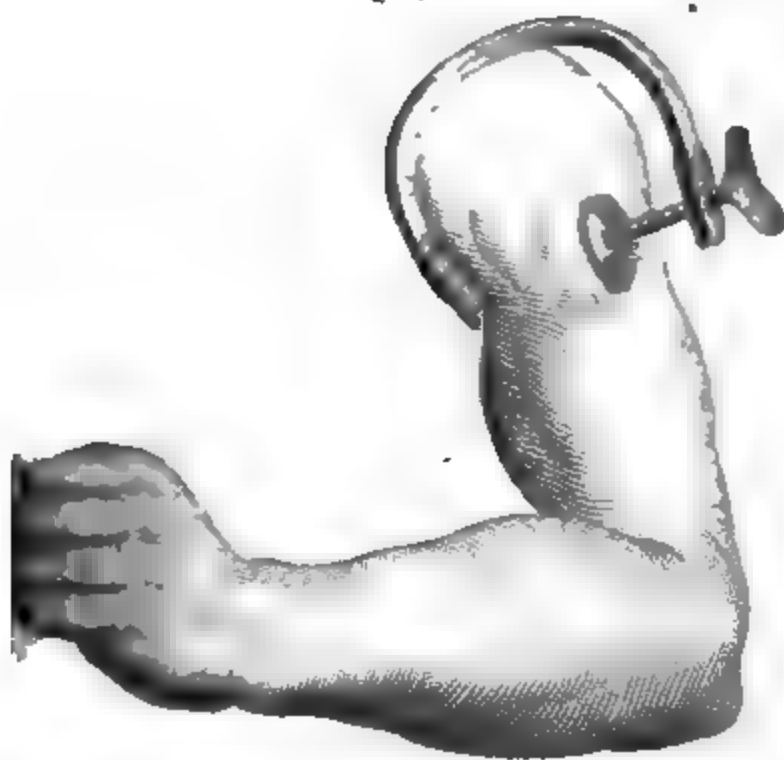


Fig. 2.



Fig. 3.





12

12

capacity to contain the thigh within its curve.

*B*, A firm compress of leather at one extremity of the instrument, to be placed on the sciatic nerve.

*C*, An oval compress fixed on a screw, passing through a hole at the other extremity of the instrument. This compress is placed on the crural nerve.

When the instrument is to be used, it is necessary in the first-place to search for the sciatic nerve: For this purpose, let the operator feel for the tuberosity of the ischium, and then for the great trochanter; and supposing a straight line drawn from the one to the other, apply the compress *B* about an inch above the middle of that line.

The crural nerve is found by the pulsation of the crural artery, which runs contiguous to it; the oval compress *C* must next be applied above it; and upon turning the screw connected with it, the sciatic nerve is pressed by *B* against the edge of the sciatic notch, and the crural nerve  
against

against the os femoris to any degree that is necessary.

Fig. 2. Represents the instrument adjusted to the thigh ; and fig. 3. a smaller compressor suited to the arm.

## PLATE CII.

In this and the four following plates, I have delineated the instruments employed in midwifery.

The forceps is perhaps the best, as it is the safest instrument employed by the accoucheur.

Various forms of it have been recommended by practitioners ; but the one delineated in this plate has been found to answer perhaps better than any other. It is sufficiently long, and the blades apply with perfect exactness to the child's head.

This instrument should measure eleven or twelve inches in length. Some have alleged that they should be longer, in order to prevent their locking within the vagina, and that they may with more ease

PLATE CH.



1.

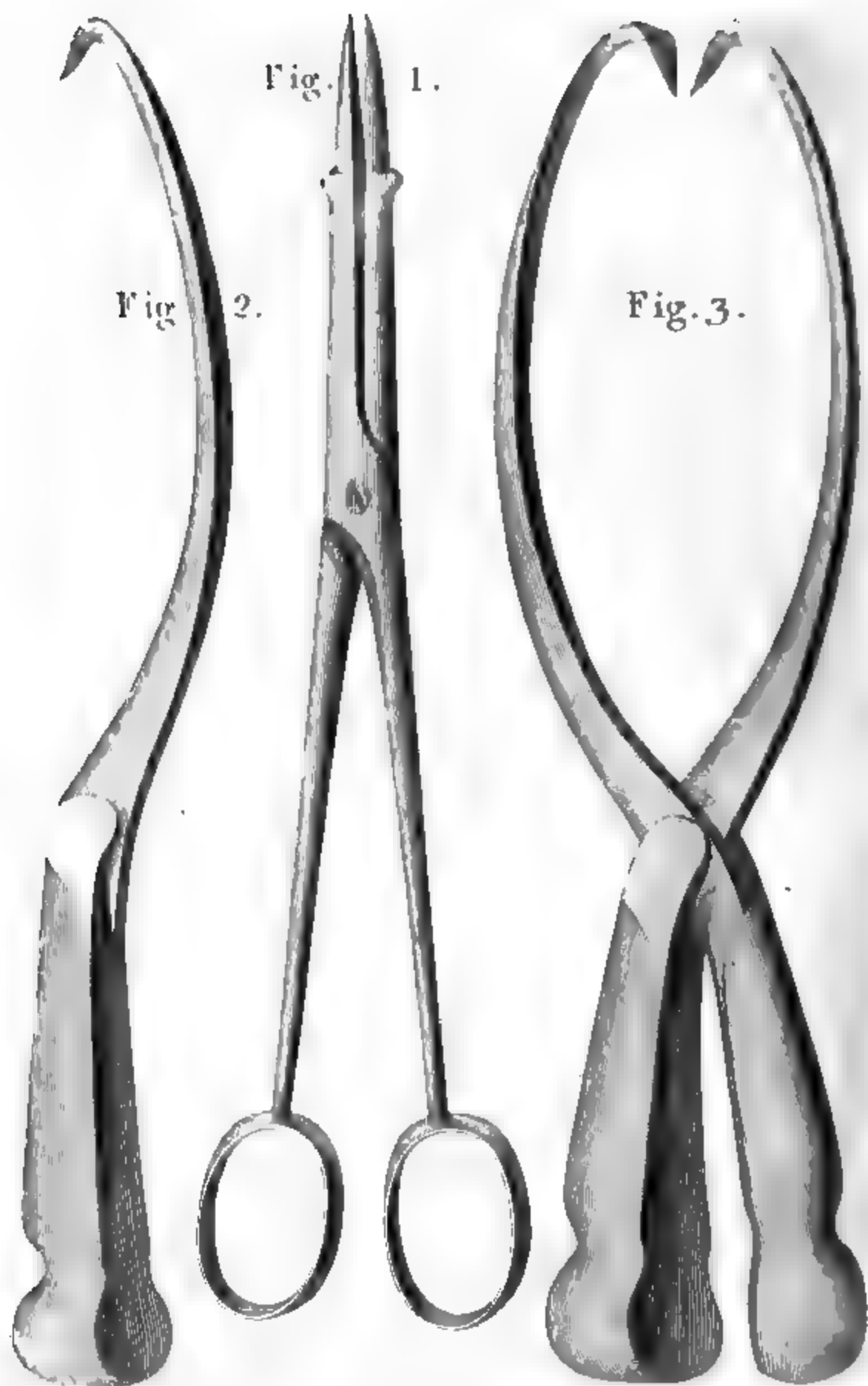


Fig. 2.





PLATE CIII.



be applied when the head of the child lies high in the pelvis ; but the length I have mentioned is by experience found to be sufficient.

PLATE CIII.

Fig. 1. Scissars used for perforating the skull of the fœtus where the pelvis is so narrow that delivery cannot be otherwise accomplished. After emptying the cranium of its contents, the child is extracted piece-meal either with the crotchet or blunt-hook, fig. 2. Plate CIV. or with the forceps, figures 1. or 3. of the same plate.

The scissars here represented are those recommended by Dr Denman.

Fig. 2. A single blade of the common crotchet, an instrument employed for tearing away the fœtus piece-meal when it cannot be delivered entire. From the form of this instrument, it obviously cannot be used but with much risk even of hurting the mother. The best rule for preventing



preventing this is to keep the point always towards the foetus.

Fig. 3. The two blades of the crotchet locked together ; in which way they may be used with perfect safety to the mother.

#### PLATE CIV.

The forceps, figures 1. and 3. as well as the blunt-hook, figure 2. of this plate, are intended, as was mentioned in the explanation of the preceding plate, for extracting the foetus piece-meal, when it is judged necessary to accomplish delivery in this manner.

#### PLATE CV.

The instruments in this plate, and the fillet, fig. 3. in Plate CVI. are the invention of my friend the late Sir Thomas Bell, a practitioner of eminence in Dublin. They are chiefly intended for extracting the head of the foetus, when by  
accident

PLATE CIV.





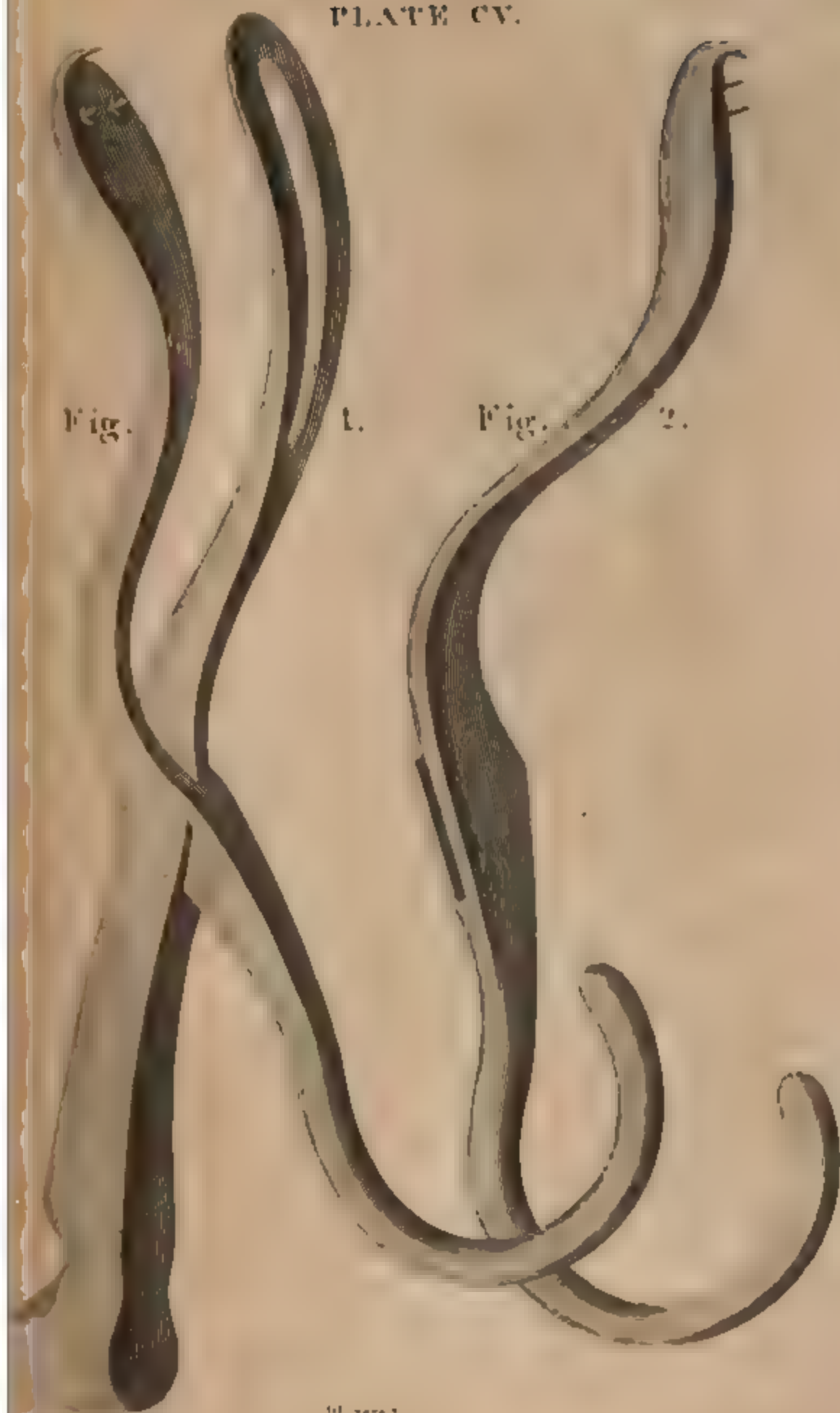
PLATE CV.

Fig.

1.

Fig.

2.



61. 2000



accident or improper management it is separated from the body in cases of narrow pelvis.

By a proper application of the fillet the head is steadily fixed till it is sufficiently opened for discharging the brain; when, with the forceps here delineated, the parts are extracted. These forceps consist of two blades; one nearly of the ordinary form; the other convex; and its convexity being adapted to the concavity of the other, the two occupy much less space than they otherwise would do; by which they are peculiarly well fitted for acting in a narrow pelvis. The teeth with which one of the blades is furnished, give these forceps a very firm hold of any part to which they are applied: And as they may be used with safety, I think it probable that in many cases they may supersede the use of the crotchet.



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PLATE CV.

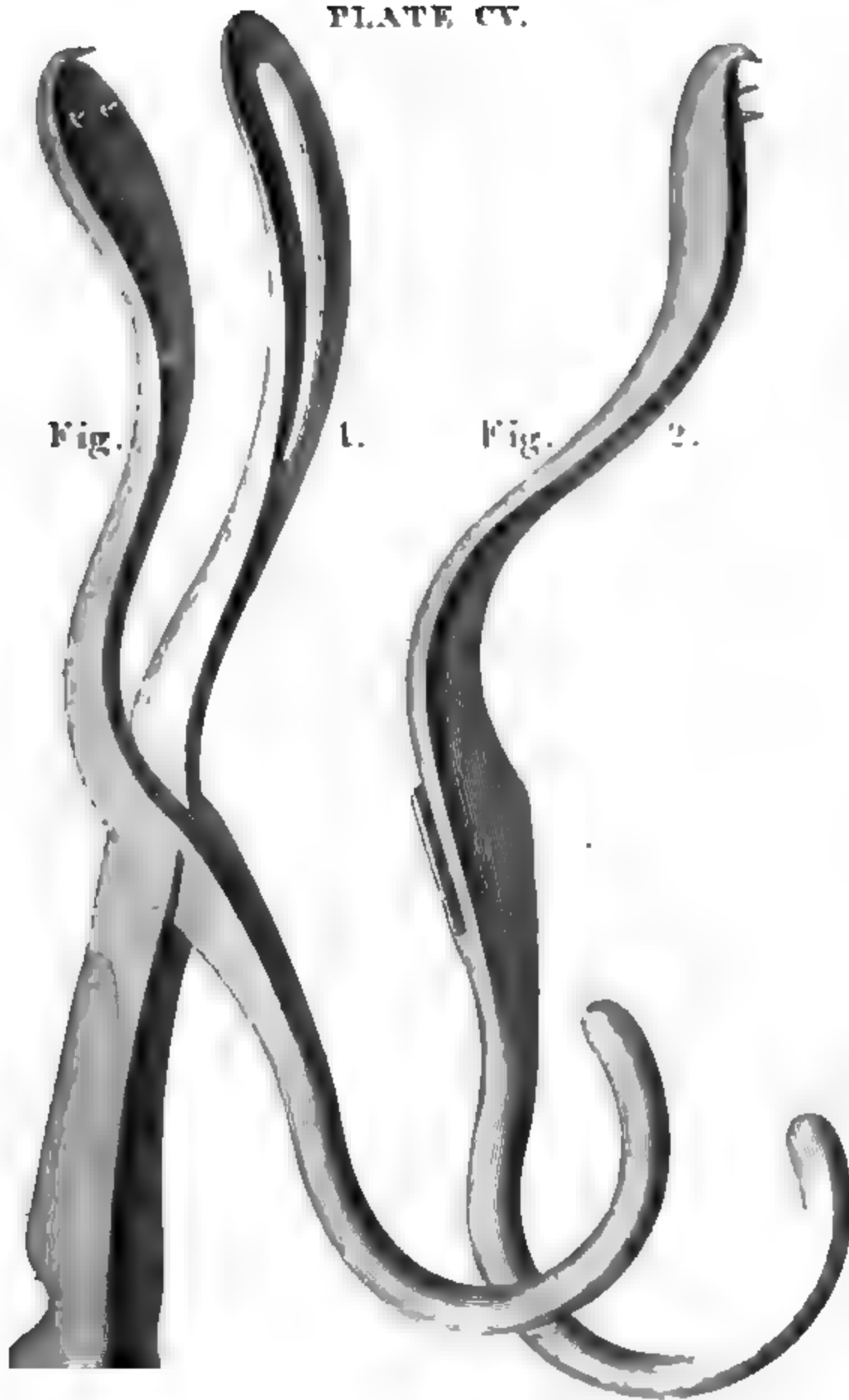


Fig.

1.

Fig.

2.

1

2

accident or improper management it is separated from the body in cases of narrow pelvis.

By a proper application of the fillet the head is steadily fixed till it is sufficiently opened for discharging the brain; when, with the forceps here delineated, the parts are extracted. These forceps consist of two blades; one nearly of the ordinary form; the other convex; and its convexity being adapted to the concavity of the other, the two occupy much less space than they otherwise would do; by which they are peculiarly well fitted for acting in a narrow pelvis. The teeth with which one of the blades is furnished, give these forceps a very firm hold of any part to which they are applied: And as they may be used with safety, I think it probable that in many cases they may supersede the use of the crotchet.

## PLATE CVI.

Fig. 1. A fillet of whalebone covered with a sheath, which by some is employed, in difficult labours, for pulling down the head of the fœtus. In general, however, the forceps answer better.

Fig. 2. A curved instrument, with an opening at one end, for applying ligatures round polypous excrescences in the uterus. It is the invention of the late Dr Hunter of London, and it answers the purpose in the easiest and most effectual manner.

Fig. 3. A fillet mentioned in the explanation of the preceding plate as the invention of Sir Thomas Bell of Dublin: It is a material improvement of the common fillet represented in figure 1. of this plate.

PLATE

PLATE CVI.

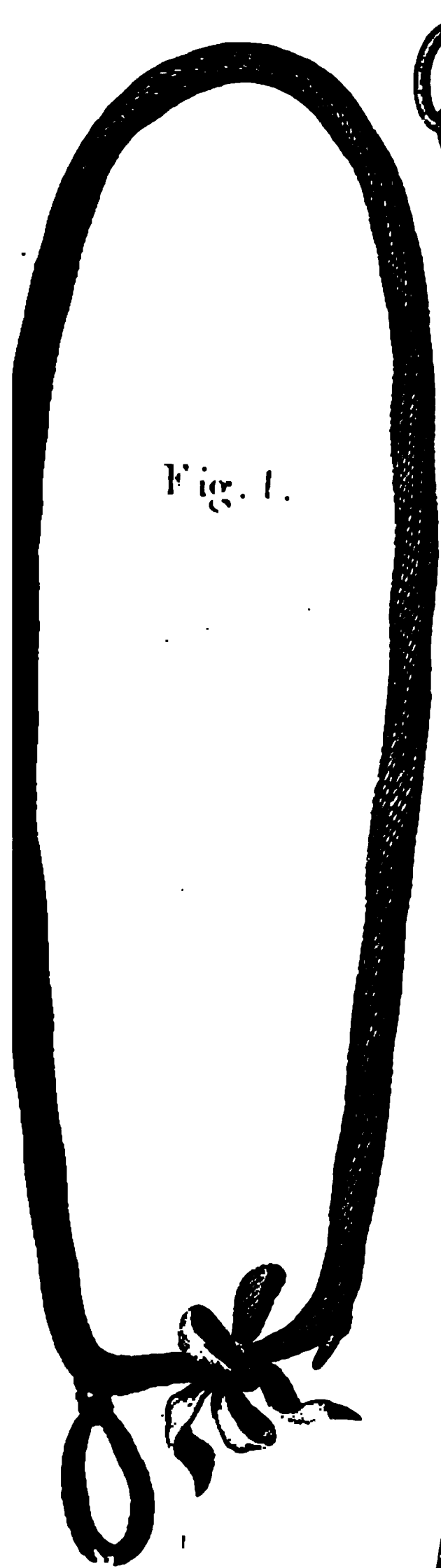


Fig. 1.



Fig. 2.

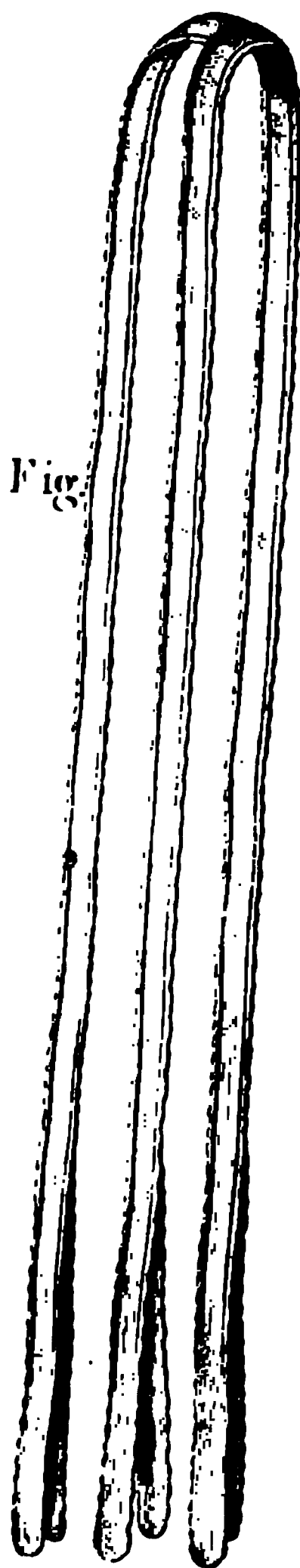


Fig. 3.









Fig. 3.

Fig. 4.



Fig. 5.

Fig. 6.

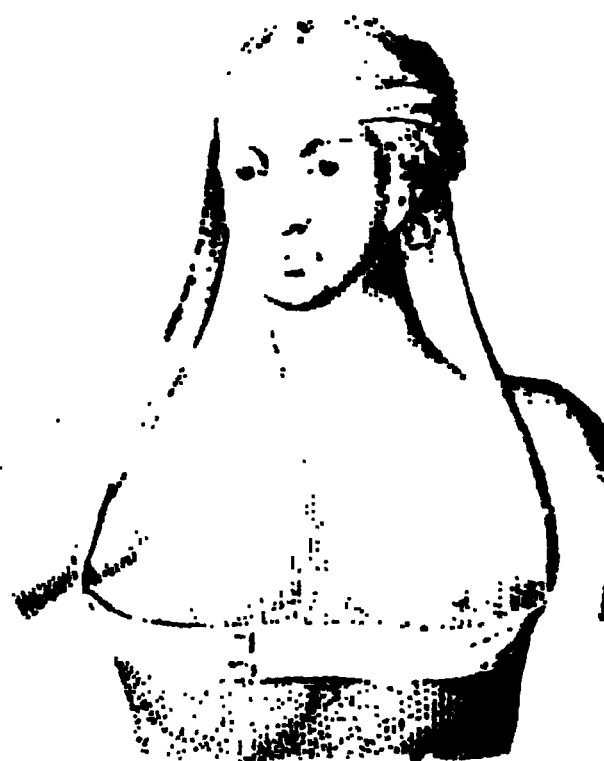


PLATE CVII.

Fig. 1. I have here delineated a night-cap, fixed in such a manner as to serve as one of the best bandages for the head.

Fig. 2. The common triangular napkin, or couvre-chef of the French, usually employed as a bandage for the head.

Fig. 3. The radiated bandage, as it is usually termed. It is commonly employed for compressing the temporal artery; and it answers equally well for stopping hemorrhagies in any arteries of the head, as may be seen in fig. 4. where the knot or turn is made at the angle of the jaw.

Fig. 5. The bandage usually employed for fractures of the lower jaw, as well as for wounds and other injuries of the under lip and chin.

Fig. 6. A bandage for supporting the head. It is formed by a proper application

cation of the double-headed roller, fig. 2.  
Plate CVIII.

### PLATE CVIII.

Fig. 1. A common single-headed roller;  
a bandage that answers for various purposes in surgery.

Fig. 2. A double-headed roller.

Fig. 3. A double-headed roller with a slit in the middle, forming what is termed the Uniting Bandage.

Fig. 4. A four-headed roller, usually employed for fractures of the lower jaw and injuries of the contiguous parts.

Fig. 5. A bandage with twelve heads or tails applied to a leg. This, as I have had occasion to observe in various parts of this work, is the most useful bandage for fractures, as well as for many other affections of the thighs and legs. In fig. 7. I have represented a bandage of the same kind,



Fig. 1 PLATE CABLE. Fig. 2.

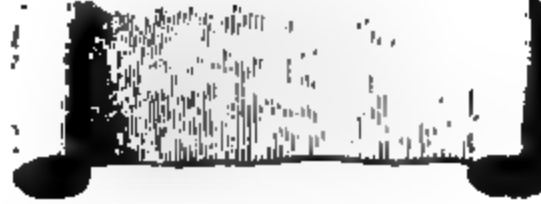
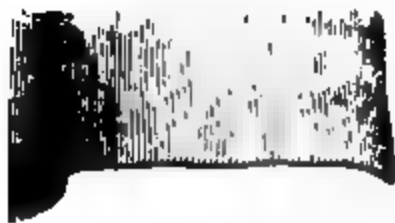


Fig. 3.

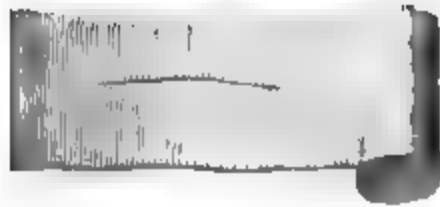


Fig. 4.

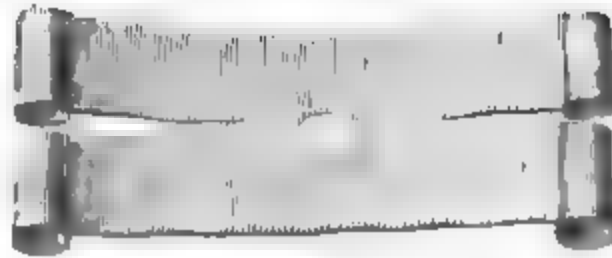


Fig.

5.

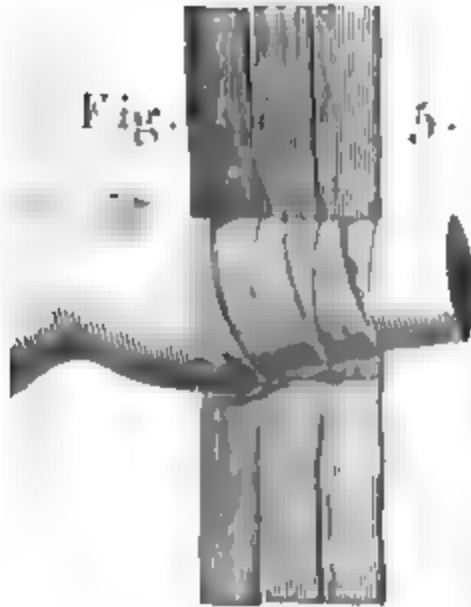


Fig.

6



Fig. 7.

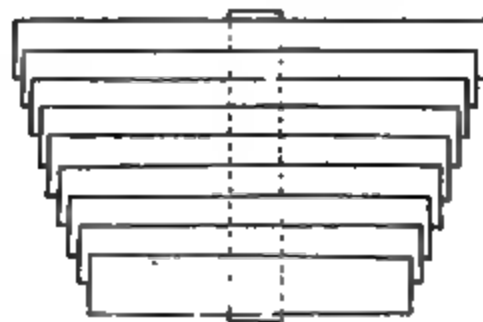






PLATE CX.

Fig. 1.

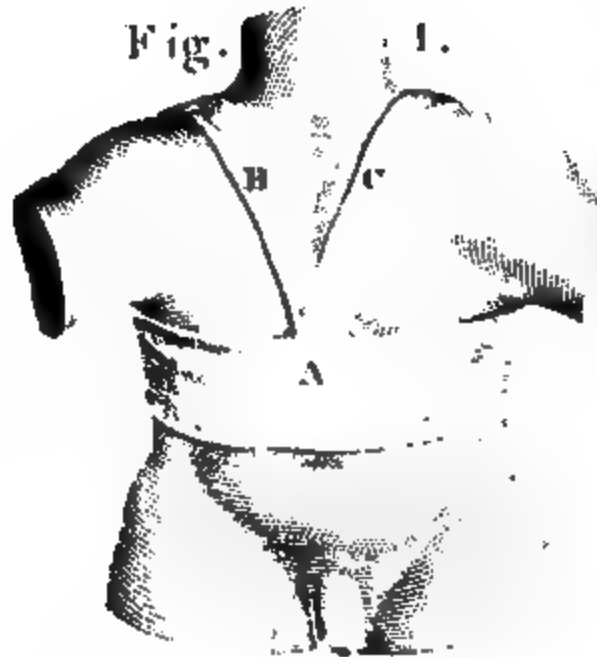


Fig. 2.

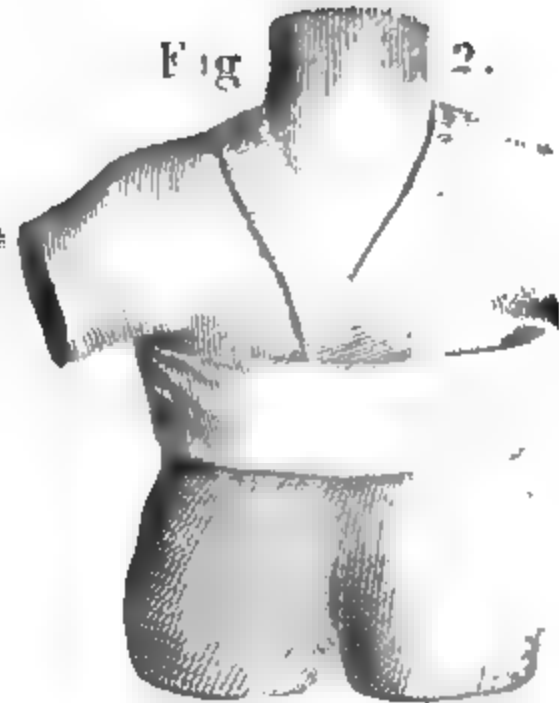
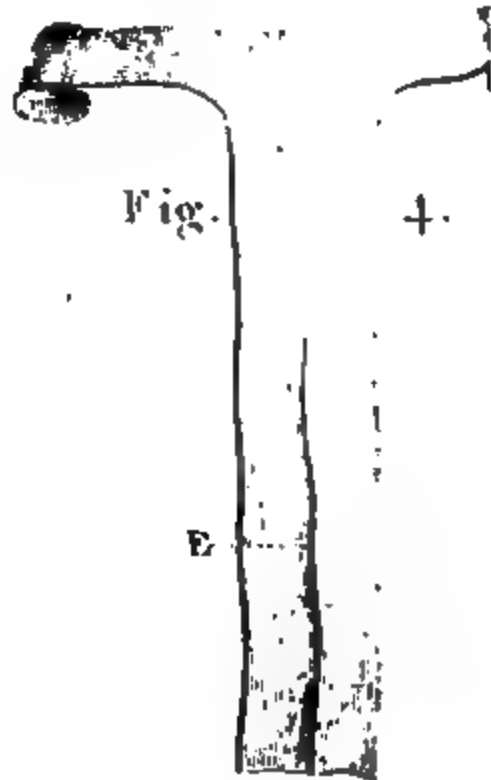


Fig. 3.



Fig. 4.



kind, made in a manner commonly used in some of the London hospitals.

Fig. 6. The uniting bandage, fig. 3. applied to a wound in the arm.

PLATE CIX.

Figs. 1. and 2. A front and back view of the napkin and scapulary, the most useful bandage for almost every part of the thorax and abdomen.

Figs. 3. and 4. Different forms of the T-bandage. This bandage proves particularly useful in diseases of the anus and perineum. *D*, a hole for admitting the penis. At *E*, that part of the bandage which passes between the legs is divided into two; one part of it passing on one side of the penis and scrotum, and the other on the opposite side.



## PLATE CX.

In this plate I have delineated the different forms of suspensory bandages for the scrotum. They may be made either of linen, cotton, or flannel; but soft cotton answers best.

Each bandage consists of a circular *A*, which is fixed round the body above the bones of the pelvis, and a pouch or bag connected with this: The principal difference between them consists in the form of the pouch, and in the manner by which it is fixed to the circular. In figs. 1. 2. 3. and 4. the pouch is connected with the circular both before and behind. Of these, fig. 3. I think is the best.

Where the scrotum is of such a size, that the pouch or bag, when fixed upon it, will remain, the two bands, which pass between the thighs for fixing it behind, are unnecessary: Fig. 5. represents a form of it for this purpose.

PLATE

PLATE CX.

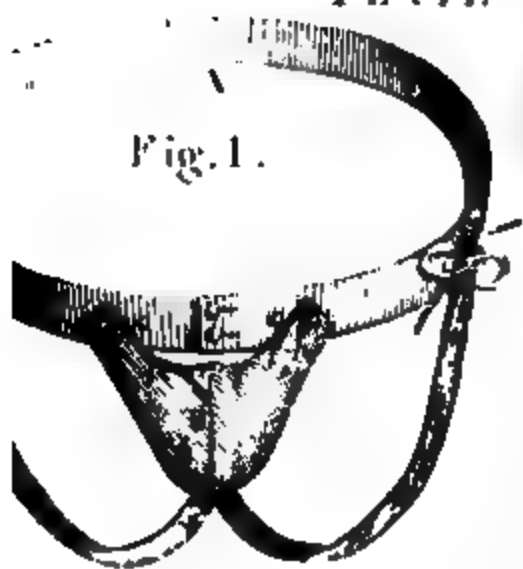


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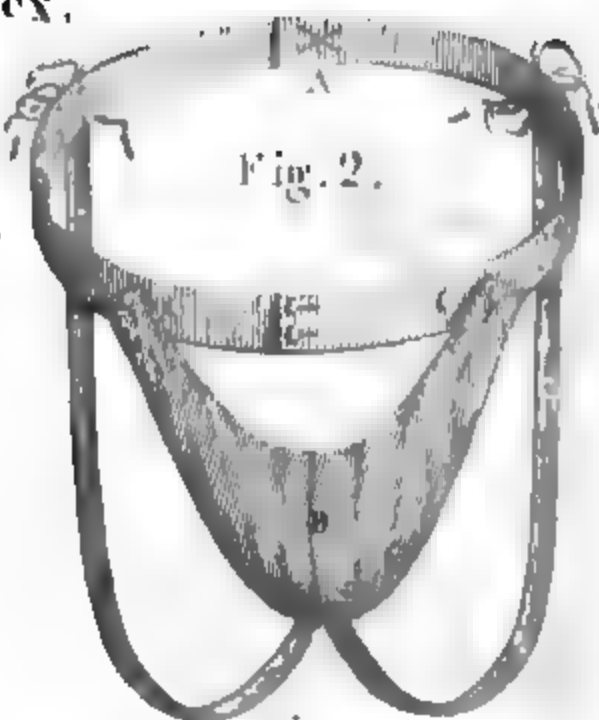


Fig. 2.

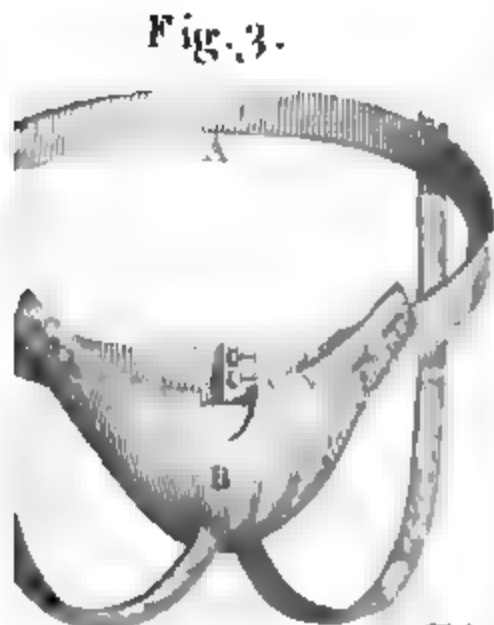


Fig. 3.

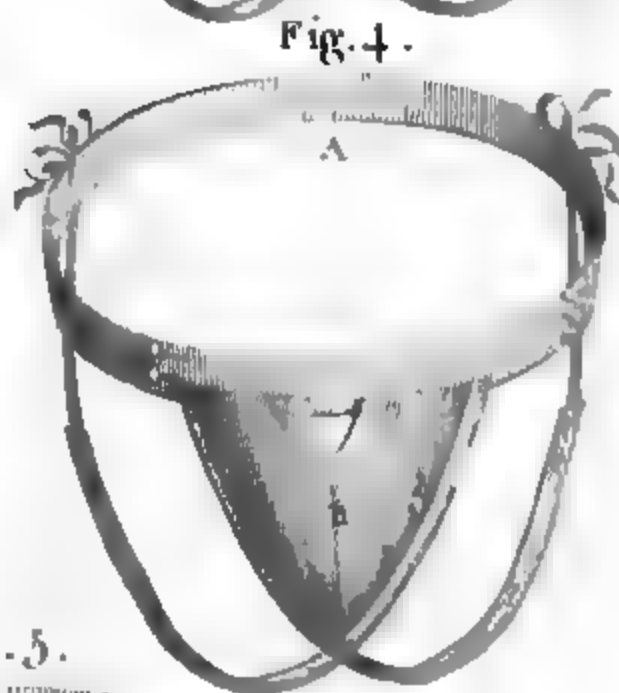


Fig. 4.



Fig. 5.





PLATE CIII.



1.

Fig.



2.

Fig.



3.

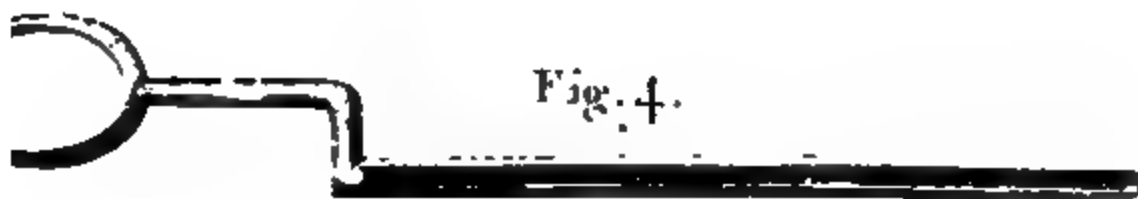


Fig. 4.



PLATE CXII.

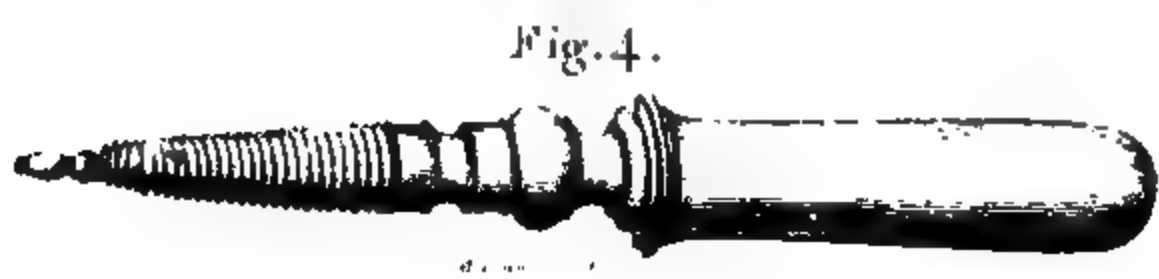
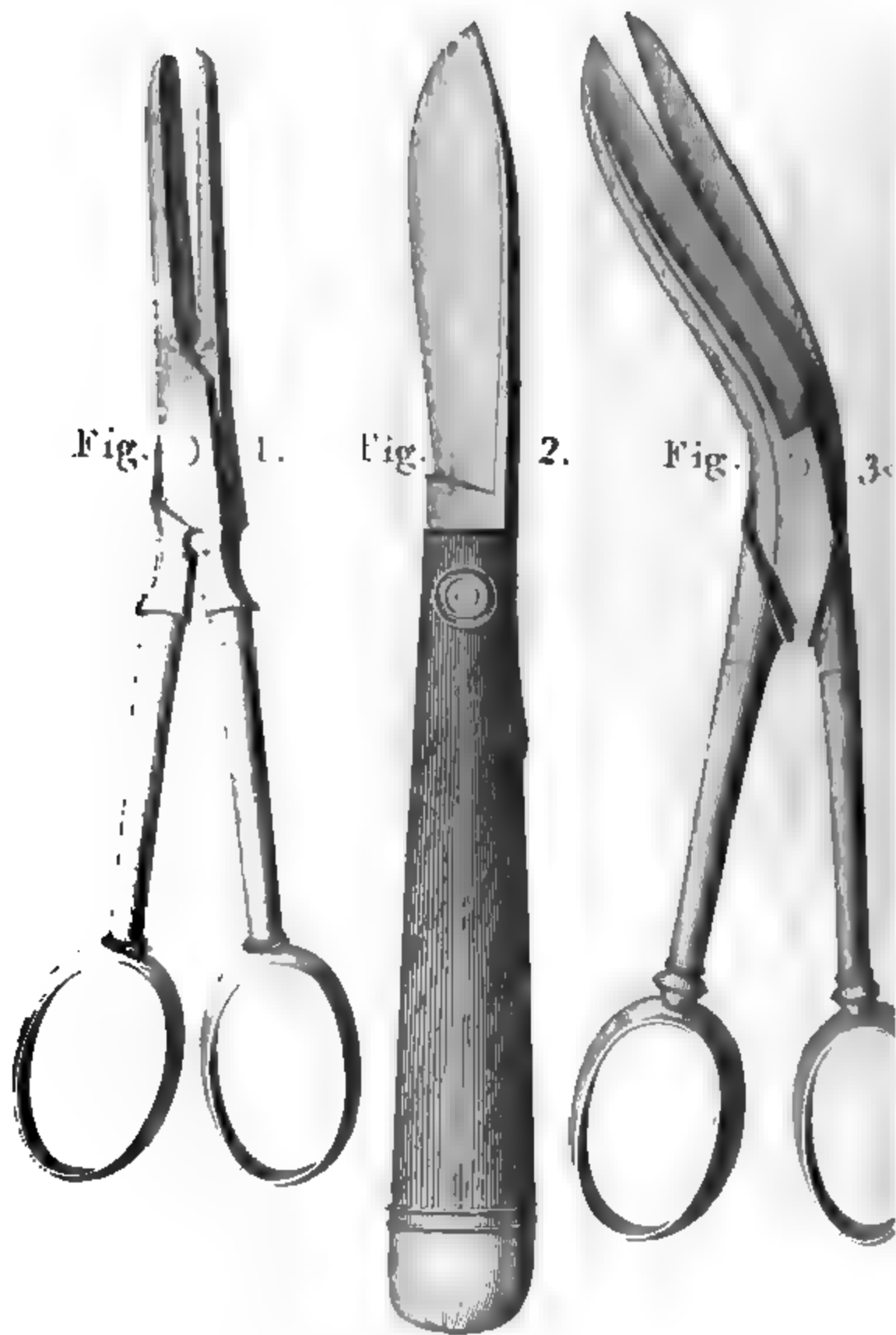
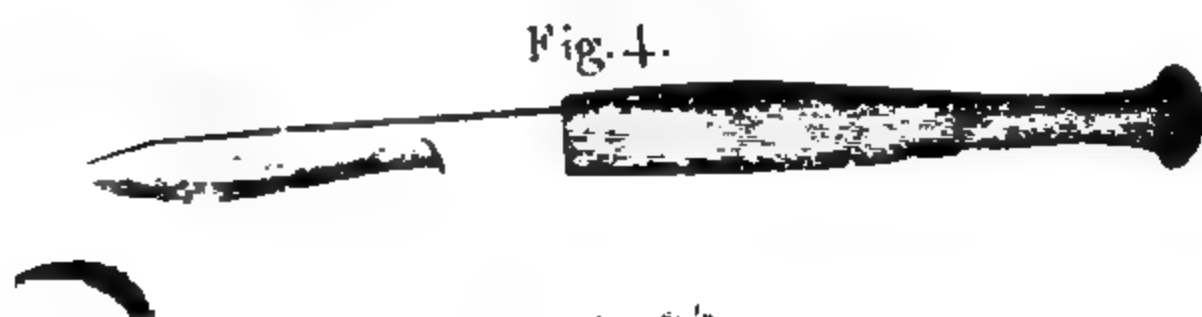
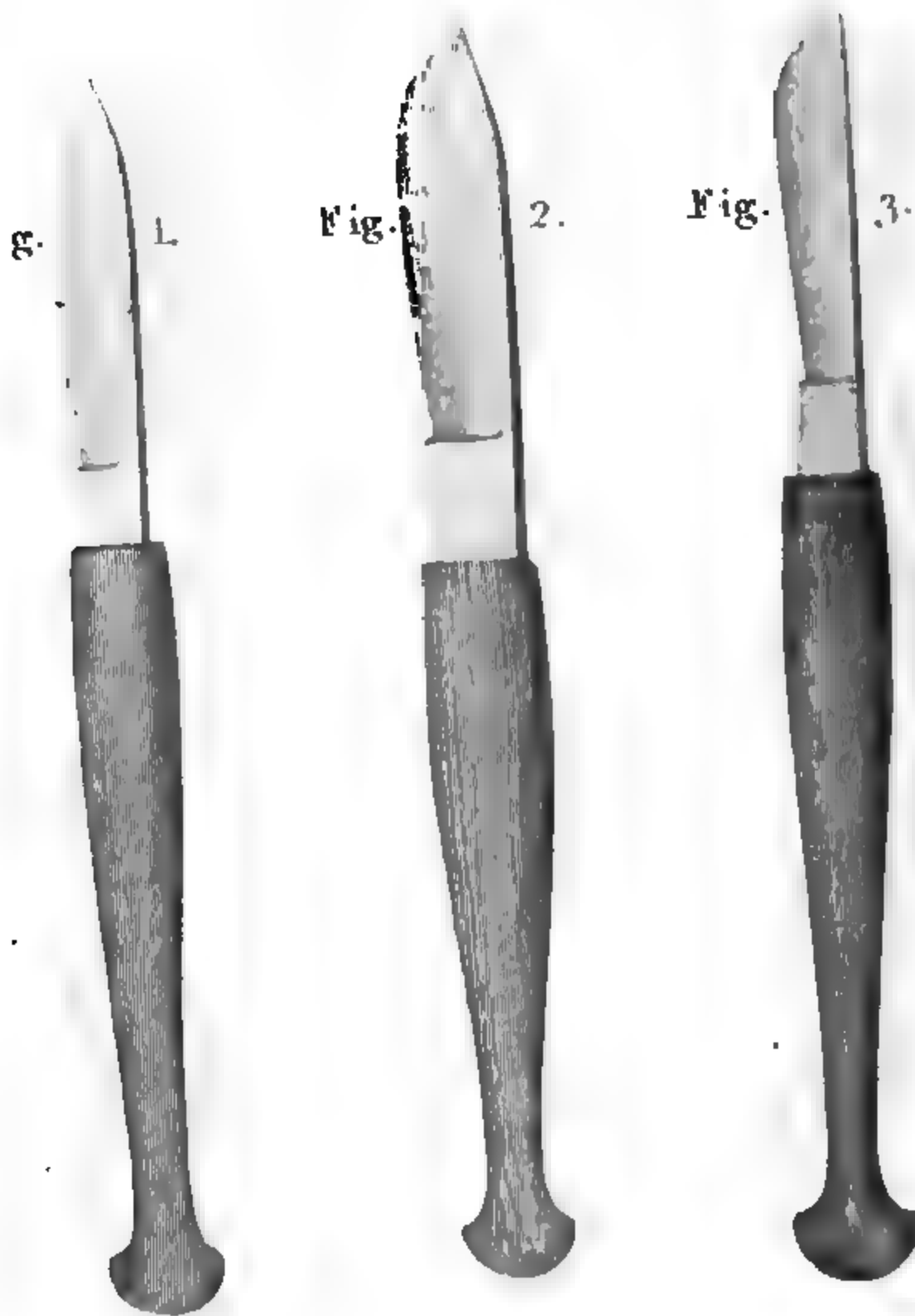






PLATE CXL.



## PLATE CXI.

The figures of this plate represent the different forms of scalpels in common use : Any of them answer the purpose, but fig. 1. cuts more easily than the others. Fig. 4. proves useful in some of the lesser operations, such as opening the sac in the fistula lachrymalis. This last is of a full size for these purposes ; but the larger scalpels should be six inches long, and stronger than they are usually made.

## PLATES CXII. and CXIII.

In these two plates I have delineated instruments for a pocket-case, for which surgeons have daily occasion.

Plate CXII. fig. 1. Forceps. Fig. 2. a round-edged scalpel. Fig. 3. crooked scissors. Fig. 4. a case for caustic and red precipitate.

Plate CXIII. figs. 1. and 3. Different forms of probes. Fig. 2. a spatula. Fig. 4. a director.

These with a probe-pointed bistoury, fig. 3. Plate LXIV.; a tenaculum, Plate III. fig. 1.; a scarificator, Plate XXXVI. fig. 4. and a few crooked needles of different sizes, form a very complete set for a pocket-case.



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